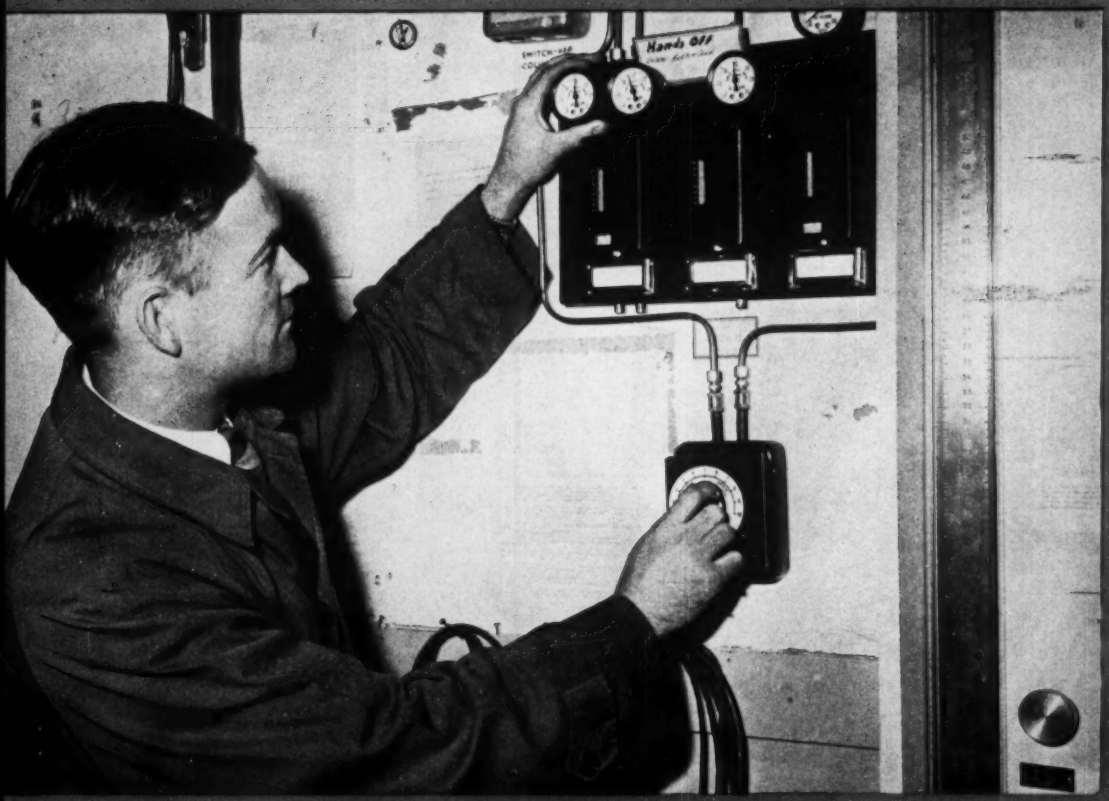
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

MAY ★ 1951

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 109—Journal Section of The American Society of Heating and Ventilating Engineers



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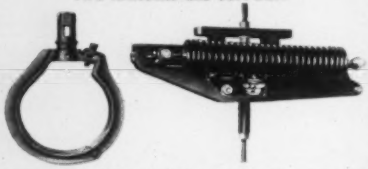
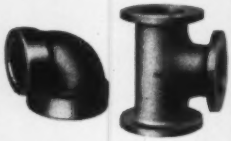
EVERYTHING FOR PIPING

PIPE HANGERS and SUPPORTS

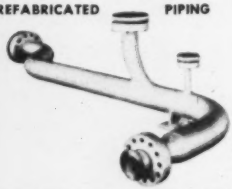


CAST IRON FITTINGS

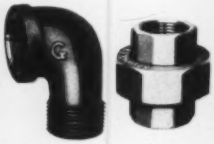


WELDING FITTINGS

PREFABRICATED PIPING

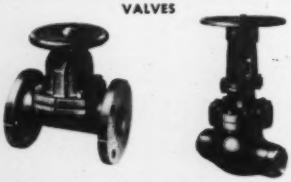


MALLEABLE IRON FITTINGS



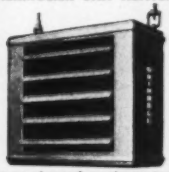
FORGED STEEL FLANGES

VALVES

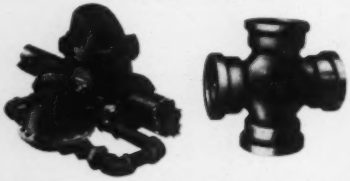


STEEL NIPPLES

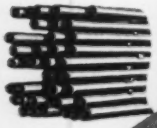
THERMOLIER UNIT HEATERS



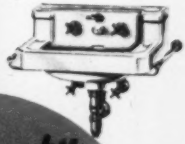
WATER WORKS SPECIALTIES



PIPE



PLUMBING and HEATING SUPPLIES



Whatever your requirements for pipe, fittings, valves and other standard piping materials, you can get prompt delivery from a Grinnell warehouse or jobber. When the job calls for specialized piping products or installations, Grinnell has the manufacturing facilities, products, experience and engineering knowledge to "deliver the goods".

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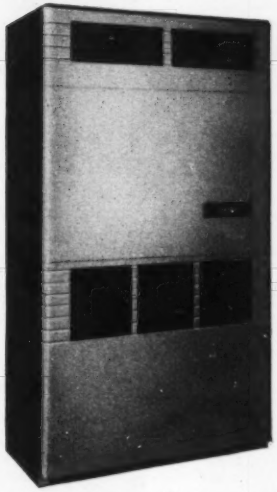
Tools of Air Conditioning

JOB IDEAS BY usAIRco



Entire building Air Conditioned with 12 usAIRco STORE UNITS

Job started May 10; finished June 27. Building was occupied during installation period. Twelve 7½ ton units were used, two per floor, running duct work in corridors, registers to each room.

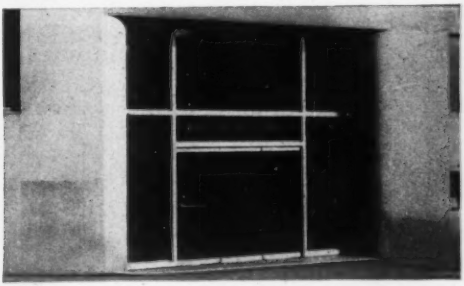
Says owner L. W. Leggett, "We have had many compliments about our air conditioning and the efficiency with which the job was installed. We believe this is the most economical way to air condition a building already built."

Contractor was Neill's Sheet Metal Company, Midland, Texas.

THE SUN'S HOT in Texas—but offices in this 6-story office building are cool—thanks to 12 usAIRco Store Conditioners—teamed up, 2 per floor.

UNITED NATIONS AGREE ON usAIRco EQUIPMENT

Here is where better air is made. Included in the installation are usAIRco Blowers, Coils, Unit Heaters, Unit Air Conditioners.



Entry way of beautiful United Nations Manhattan building. Architects: Fellheimer & Wagner. Engineer: Paul Wunderlich.

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Address_____
City_____ Zone____ State_____

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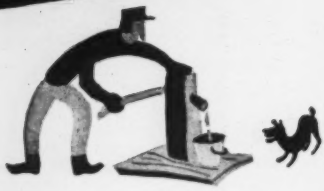
Everything In Air Conditioning

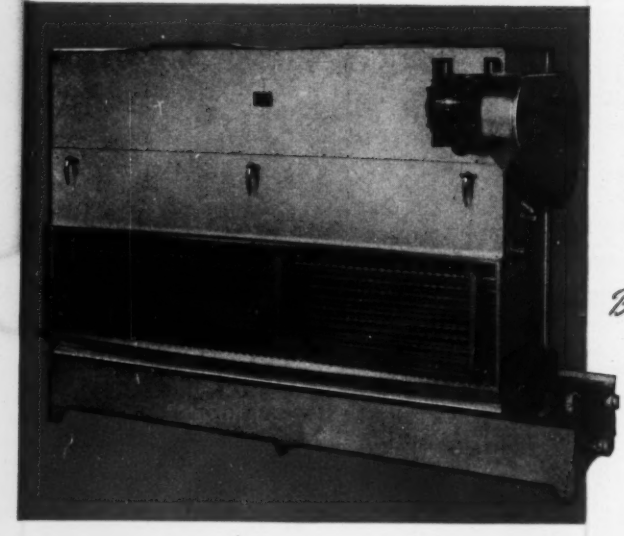
CONSERVE WATER

BUSH Cooling Towers



For localities where water is scarce or costly . . . or water temperatures high . . . the logical solution is the Bush Cooling Tower which reuses water by cooling it after it leaves the condenser. The Bush Cooling Tower, in 3 to 75 ton capacities, is of the induced draft type . . . can be located anywhere in a building . . . and is equipped with centrifugal fans to handle an ample air volume through duct work for either intake or discharge.

BUSH Evaporative Condensers



Soundly engineered and ruggedly constructed in 5 to 75 ton capacities with welded steel frame hot-dipped galvanized after fabrication. For easy installation all units are designed to minimum depth . . . or built in sections to facilitate moving through standard width doors. All inside surfaces and frame completely covered with bitumastic compound for additional protection against corrosion.

Buy the Best-and the Best is Bush

Bush
HEAT TRANSFER PRODUCTS

Heating Piping & Air Conditioning

Vol. 23, No. 5

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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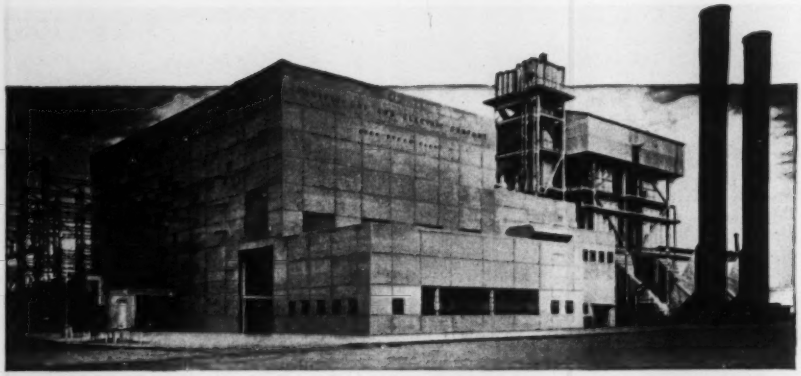

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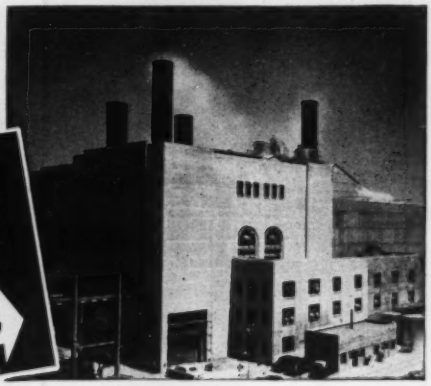

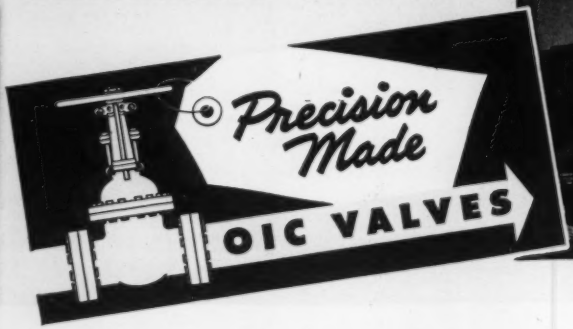

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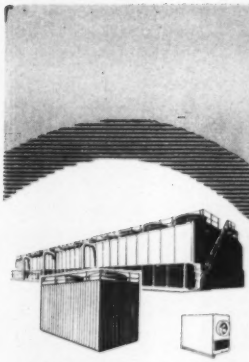
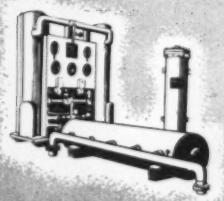


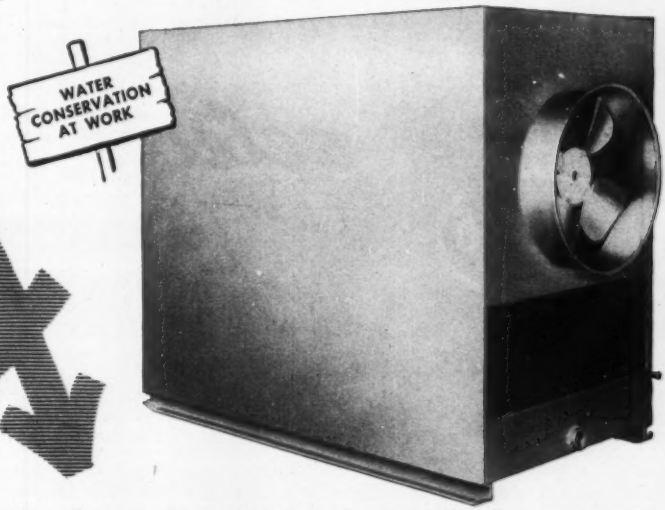
COOLING TOWERS



GAS EQUIPMENT

AIR COOLED HEAT EXCHANGERS

Producers of QUALITY Specialized Process EQUIPMENT



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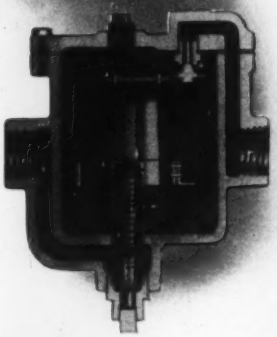
This beautiful, modern bakery just completed by National Biscuit Company in Portland, Oregon, features many innovations. For example, the large tower at left is designed for the storage of raw materials. Each baking unit measures over 600 feet from cutting machine to packing department. The new plant greatly augments NABISCO's service to food merchants and consumers in the expanding Pacific Northwest.

Four types of SARCO STEAM TRAPS are used

Sarco furnished, for the heating system, four different types of steam traps, including a large number of the inverted bucket type as illustrated.

Efficient steam trapping, of course, depends upon the selection of the right type of trap for the particular job. Sarco is the only manufacturer offering a selection of four major types of steam traps, namely: inverted bucket, thermostatic, float-thermostatic and liquid expansion. Write for trap selection chart No. 1600.



SARCO INVERTED BUCKET STEAM TRAP

Since 1936 made with built-in strainer.
All mechanism on cover for easy inspection.

Engineers & Architects: Ford, Bacon & Davis, New York.
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No. 334

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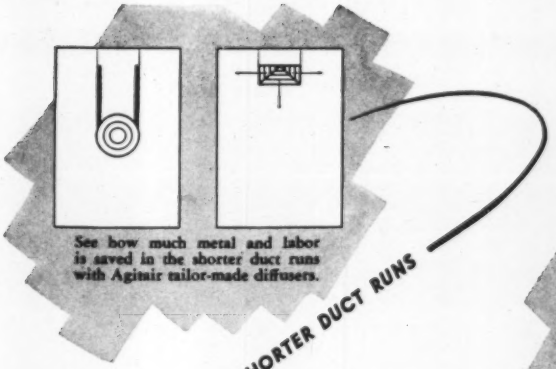
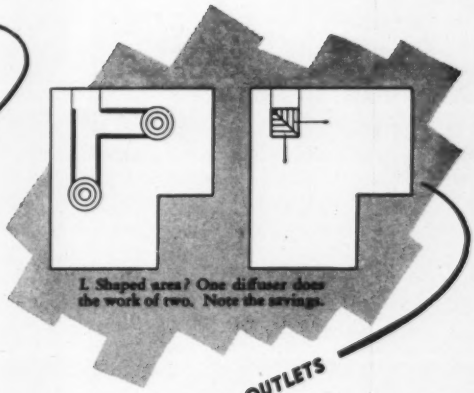


See how much metal and labor is saved in the shorter duct runs with Agitair tailor-made diffusers.

SHORTER DUCT RUNS



L Shaped area? One diffuser does the work of two. Note the savings.

FEWER OUTLETS

Save Metal...

Cut Costs...with

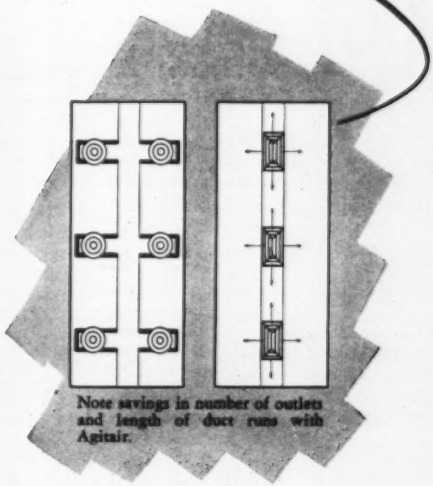
AGITAIR®

SQUARE & RECTANGULAR AIR DIFFUSERS

CONSERVE CRITICAL MATERIALS

Compare the diagrams on this page and you'll understand why today — more than ever before — it's important to specify AGITAIR Type R. They are the only diffusers that may be assembled in a variety of patterns to provide blows in one — two — three and four directions, with discharge orifices proportional to the area being served. Yes — you can help overcome the metal shortage and reduce the cost of duct work — *without reducing the efficiency of air distribution.* Specify AGITAIR . . . the only air diffuser tailor-made for each application.

Write for Complete Data



Note savings in number of outlets and length of duct runs with Agitair.

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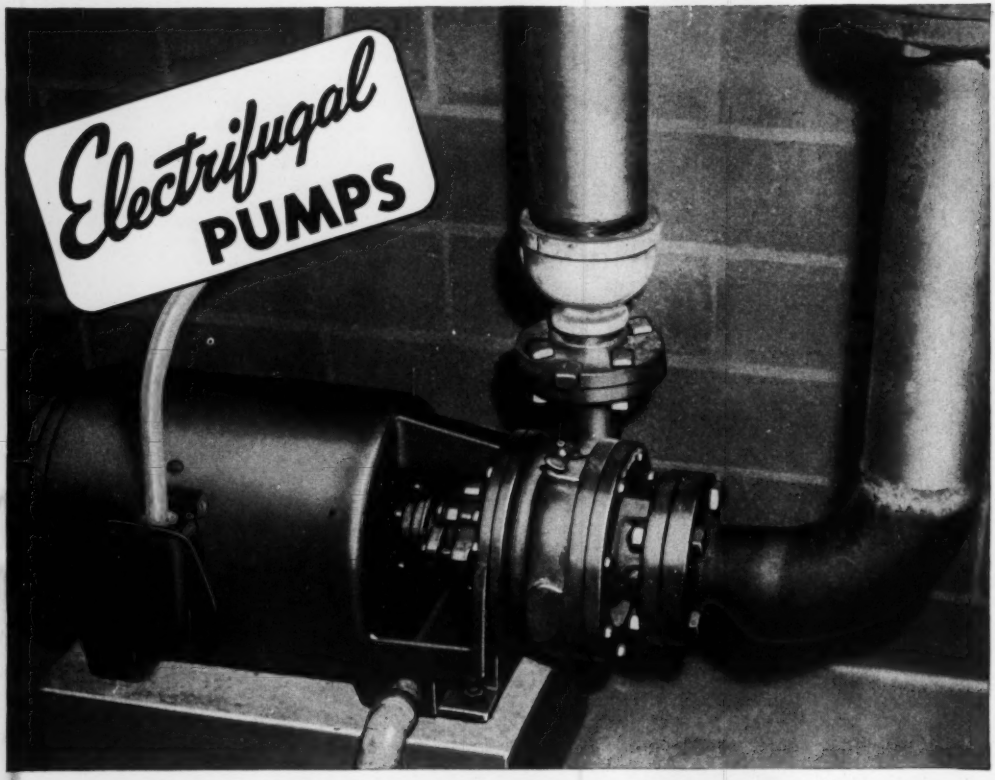

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SAVE INSTALLATION TIME AND COST by standardizing on Allis-Chalmers package pumps for air conditioning and heating. The complete pumping unit comes in one piece, ready to run. Simply bolt the pump to the floor, connect power and piping and you're ready to pump. No special foundation is required, no coulings or other extra parts.

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A-3323

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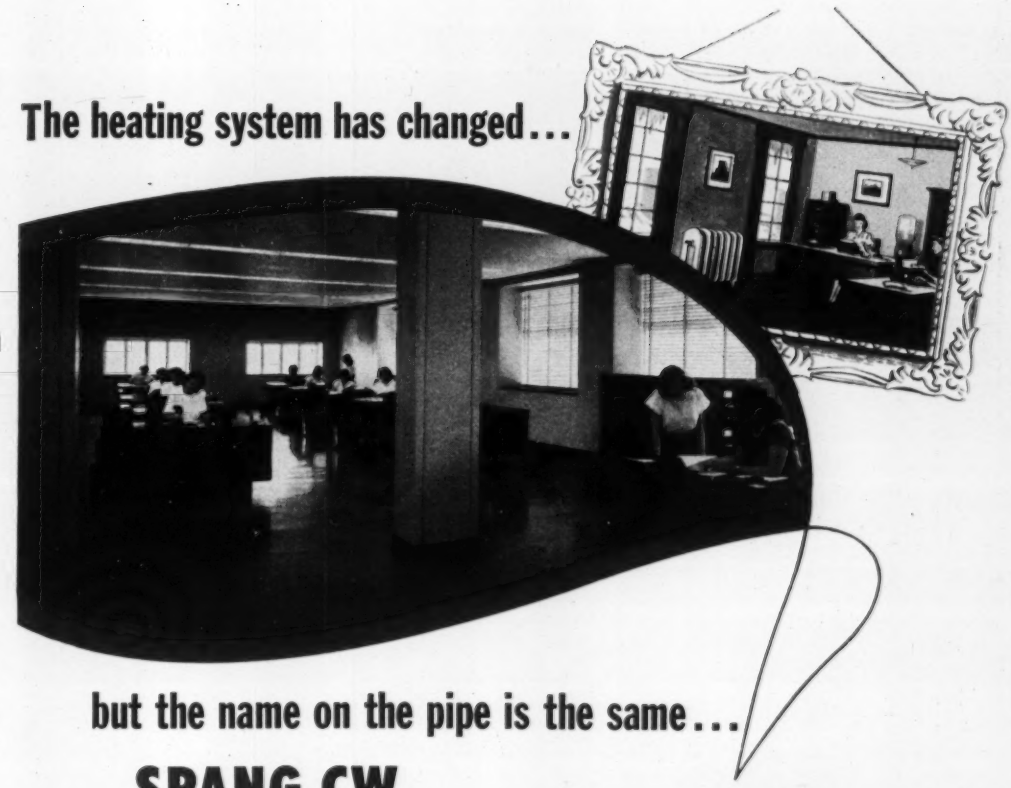

but the name on the pipe is the same...

SPANG CW

When you're planning and laying-out radiant heating systems, be sure to specify "Steel Pipe" . . . and to be sure of top-quality, specify "Spang CW Steel Pipe".

You'll like working with Spang CW Steel Pipe. It's uniform in quality, mill-tested, easy to cut, bend and weld. It's strong to withstand mechanical pressure, and rough handling. It stands up for a lifetime in closed-circuit systems.

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SPANG

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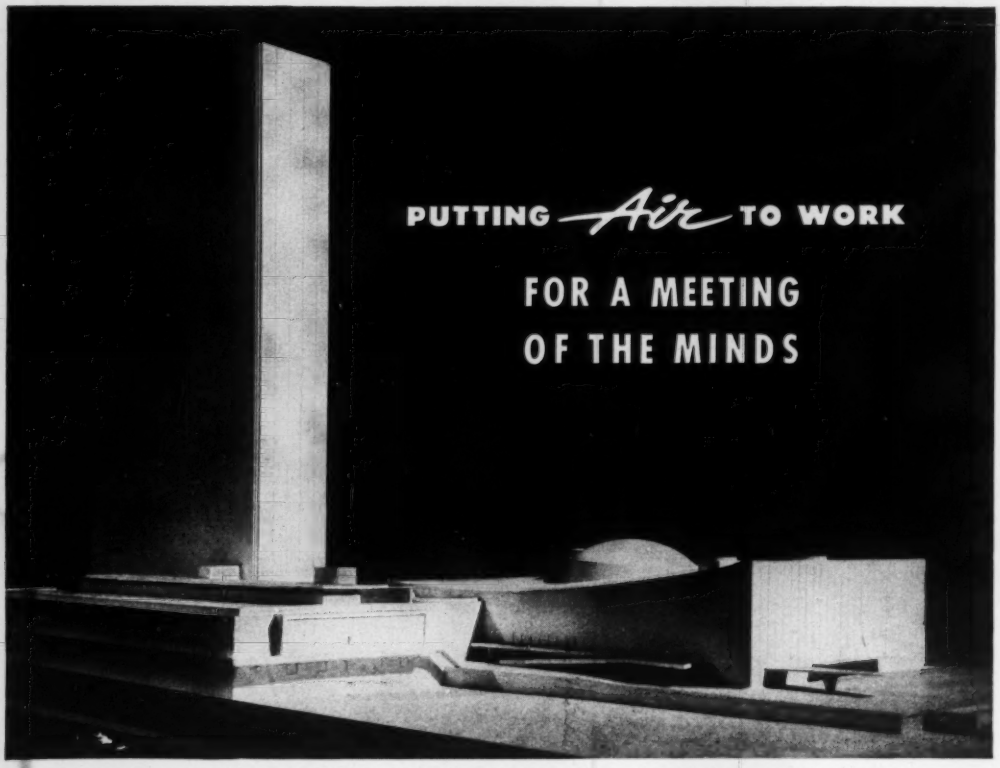
QUALITY *that is recognized wherever pipe is used*



Harrison & Abramovitz, New York, Architects • Syska & Hennessy, Inc., New York, Consulting Engineers • Fuller-Turner-Walsh-Slattery, Inc., New York, General Contractors • Kerby Saunders, Inc., New York, Mechanical Contractor, Council Chambers

The United Nations is burning the midnight oil. Because its decisions affect millions of people, it is essential that its policy-making delegates and officials meet in an atmosphere conducive to careful deliberation, free from distraction and discomfort.

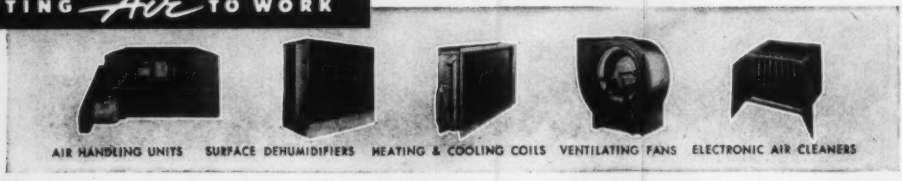
In the Council Chambers, for example, a constant flow of conditioned air provides this important atmosphere. Dependable Westinghouse-Sturtevant Air Handling apparatus contributes to the comfort and continuity of operation for which the air conditioning was designed by Syska & Hennessy, Inc., the Consulting Engineers.

There's a complete line of Westinghouse equipment to help you *put air to work* . . . with air conditioning, air moving, or air cleaning. Contact your local Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

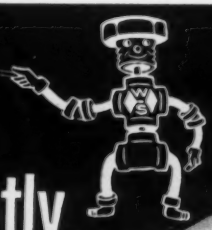
YOU CAN BE SURE...IF IT'S **Westinghouse**

PUTTING Air TO WORK

J-80217



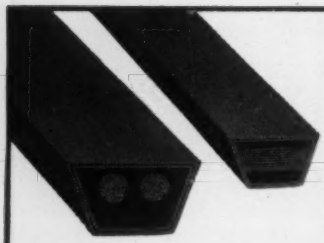
Where pipes meet permanently...



WATSON-STILLMAN

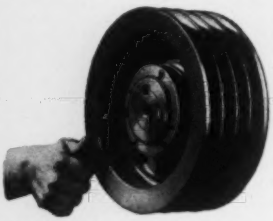
DISTRIBUTOR PRODUCTS DIVISION **WATSON-STILLMAN** ESTABLISHED 1848 • ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

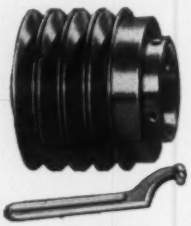


SUPER-7 V-BELT — Famous grommet or laminated construction. No splices where failure can start. Rubber cushion supports rayon cord at pitch line. Sizes and sections to suit all operating conditions.

TEXSTEEL SHEAVES — Pressed steel sheaves for applications from ¼ to 25 horsepower. Light weight and rigid. 1 to 6 grooves, A or B belts. All sizes and bores available from stock.



MAGIC-GRIP SHEAVES — Fastest mounting sheave you can buy. Aligns easily . . . cannot shake loose. 1 to 12 grooves for A-B, B, C, and D, belts. 1 to 250 hp. Stocked in many cities for immediate delivery.



VARI-PITCH STANDARD SHEAVE — Speed range of 9% to 28% on drives of 1 to 300 horsepower, using A, B, C, D, or E belts. Two to 10 grooves. These sheaves are available in either motion control or stationary control.

AUTOMATIC *VARI-PITCH* SHEAVES — Offers stepless speed control . . . one to 40 hp . . . 2 to 1 speed range. Simply move motor forward to increase speed, and move motor back to decrease. One hand does it while motor is running.

Meets Any Need for V-Belt Drives!

YOU CAN GET every V-belt drive component from the *Texrope* line: Constant speed drives; standard and wide range *Vari-Pitch* drives; speed changers; motor bases; and new or replacement long lasting *Super-7* V-belts.

Get Added Benefits

In addition, you get extra engineering skill both in the field and factory that comes from having more industrial V-belt installations than any other manufacturer.

The world's greatest store of V-belt engineering knowledge has been condensed into a 120-page *Texrope* Pre-Engineered Drive Book. Covers 90% of all constant speed V-belt drive requirements. Ask your Allis-Chalmers Authorized Dealer or Sales Office for Bulletin 6956A, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3273

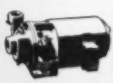
Texrope, Super-7, Vari-Pitch, Texsteel and Magic-Grip are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

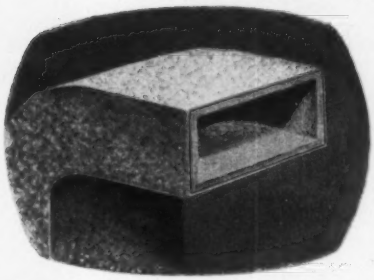


PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

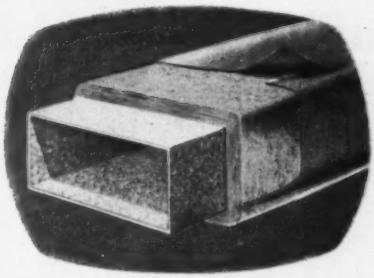
4 popular uses for ULTRALITE

The LONG glass fiber insulation!



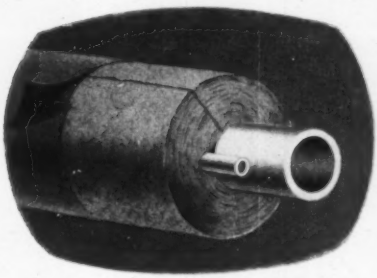
ULTRALITE—the duct liner that won't burn!

Ultralite Duct Liner is a flexible, semi-rigid glass fiber insulation designed specifically as an acoustical duct liner, with excellent sound-absorbing properties. It won't break, chip or delaminate—won't flake off in air stream! You can run it quickly around curves and corners, run it through the brakes and shears with the metal, fasten it in place with screws and washers or adhesives.



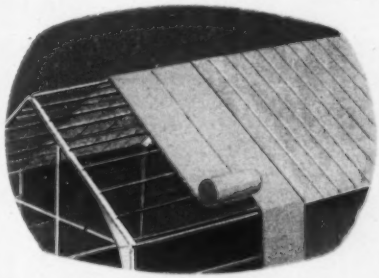
ULTRALITE—the easy-to-install duct insulation!

It's "duct soup" to wrap air ducts with Ultralite Thermal Duct Insulation—it's as easy as wrapping a package! Ultralite Duct Insulation is available plain or with your choice of 4 different vapor barrier facings, already adhered to the insulation. Ultralite is non-irritating, pleasant to handle, fire-resistant and non-corrosive to metals. K-factor is very low—and so are applied costs!



ULTRALITE—for general piping applications!

For a smooth, neat wrapping job on pipe from 1½" up, where surface temperatures do not exceed 425° F., try Ultralite! Goes on quickly, especially around valves and fittings; stands up under bumps and rough usage without breaking or losing thickness. Saves money, too—applied costs are only ⅔ that of hemi-cylinder pipe insulation for weatherproofed outside lines! Available with vapor barrier or weatherproof facings already attached.



ULTRALITE—perfect for metal buildings!

Wherever there's a place for metal buildings that need insulation, there's a place for Ultralite. No need to fasten it in place if you insulate when the building is erected; simply apply Ultralite between metal skin and structurals, and its resilience keeps it in place . . . permanently! Available with 4 attractive vapor barrier facings, already adhered to the insulation.

SEE OUR LISTING IN SWEET'S CATALOG OR MAIL COUPON TODAY FOR FULL DETAILS!

GUSTIN-BACON ULTRALITE MANUFACTURING CO.

GUSTIN-BACON MFG. CO.

1412 WEST 12TH ST., KANSAS CITY, MO.

New York Chicago Philadelphia San Francisco Los Angeles Houston Tulsa Ft. Worth

Please send me full details on: HP-5

☐ Ultralite Duct Liner ☐ Ultralite Piping Insulation

☐ Ultralite Duct Insulation ☐ Ultralite for Metal Buildings

Name_____

Firm_____

Address_____

City_____ State_____

SERVICE ON THE SPOT IN 3 EASY STEPS

1. loosen cap screws
2. raise power element
3. lift out cage

Now the valve is ready for cleaning or repair without removing it from the line. If you want to change capacity, just change the cage.

EASY—ISN'T IT!

This simplified construction also reduces friction — gives faster valve action. All internal parts are made of corrosion-resistant brass or stainless steel. For "Freon 12," "Freon-22," Methyl Chloride.

For further details, write for Bulletin 171.

See your ALCO wholesaler!

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

4629

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

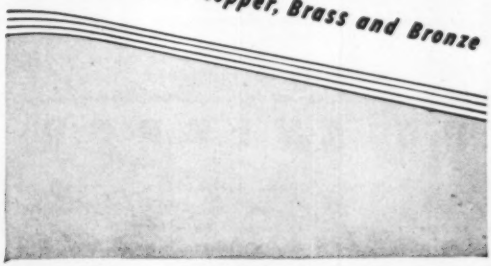
How many houses for a battle

It takes all the copper, brass and bronze in 3200 homes to build a battleship . . . in 1275 vacuum cleaners for a B-29. It takes 50 radios for a torpedo; 47 refrigerators to build a tank!

This is the challenge that copper faces in answering the call to arm. The very qualities that make copper so important in time of peace make it indispensable in time of war. There are no real substitutes for man's most useful metal. No other metal can match combination of properties that copper and alloys provide—their strength and ready wo ability, high resistance to corrosion, compl immunity to rust, unusual ability to condu heat and electricity.

Because there's not enough copper to serv our military needs and all of our civilian wants as well, it has been necessary to restrict non-

First in Copper, Brass and Bronze



We're telling your customers why copper is best—but scarce

This full-page, full-color Anaconda advertisement, one of a series appearing every month in *The Saturday Evening Post*, is doing a double job that will pay off for you. It explains why copper is scarce for homes because more and more of it is needed to help arm America. And it reminds your customers of the matchless job that copper does in homes—looking to the day when more of it will be available for civilian uses.

If you would like copies of this or other advertisements in *The Post* series for your own use, just write to: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

51-67A

Nothing serves like ANACONDA® COPPER TUBES

SYLPHON CONTROLS FOR DEPENDABILITY

NEW!

SYLPHON No. 999 temperature regulator

MORE POWERFUL • STAINLESS STEEL FRAME FOR MINIMUM HEAT CONDUCTION • LESS HEIGHT AND WEIGHT • LARGE SIZE, 2-PLY SYLPHON BELLOWS FOR ADDED POWER • SELF-OPERATING

THIS NEW ADDITION to the Sylphon line is highly recommended for all industrial processes requiring accurate, dependable temperature control. Particularly suited for storage water heaters . . . metal plating tanks . . . bottle washers . . . treaters . . . slashers . . . etc.

Like all Sylphon regulators, No. 999 is self-powered. It requires no compressed air or other auxiliary power source. It's ideal as standard equipment. Thoroughly dependable. Simple and compact. Sturdily built for long service life.

Also available with fin type bulb for controlling temperature of air or gases. Other models: 999-A has over temperature protection; 999-T equipped with dial indicating thermometer. Write for complete details. Ask for Catalog JH-A.

FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON DIVISION

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

Just Out!

NEW 36-PAGE EDITION OF

PIPING POINTERS

...a bigger, more helpful handbook for training maintenance workers

You asked for ¼ million copies of the last edition of Piping Pointers. You found it a big help in training beginners and refreshing veterans in your piping crews. The bigger and better edition is just out —changed in appearance but not in purpose. Crane again offers this booklet—to help keep your piping systems at peak efficiency.

Piping Pointers talks facts . . . not theory. Thoroughly covers the fundamentals of good, sound, everyday piping practices . . . in easy-to-grasp, nontechnical language. Its many "how-to-do-it" features are illustrated for easy understanding.

Mistakes in piping installation and maintenance cost more today. Piping Pointers can help your men avoid them. Just ask your Crane Representative for a copy.

PARTIAL INDEX TO PIPING POINTERS

HOW TO choose valves for every service . . . install valves . . . read reducing fittings . . . make up screwed joints . . . assemble flanged joints . . . make up solder joints . . . install pressure regulators . . . use vent and drain valves . . . avoid steam trap trouble . . . save on pipe joints and materials . . . handle piping tools.

plus THE CRANE VALVE SELECTION GUIDE

which saves time and effort in selecting valves for common piping services.

PIPING POINTERS 16-mm SOUND FILM
Free Usage for Group Training

A 30-minute motion picture that dramatizes the fundamental information in the Piping Pointers Manual. Ideal for classroom or plant training groups. Available on request through your local Crane Branch.

CRANE

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

"BEST AIR CONDITIONING JOB in an existing building in Texas," says Paul E. Wise of Houston's Sterling Building, one of many recent G-E Personal Weather Control installations. To save space, particularly important in existing buildings that were not originally designed for air conditioning, small-size, high-pressure ducts were used for ventilation. Consulting engineer: Hollis U. Bible. Air conditioning contractor: Sebastian Air Conditioning Corporation.

AIR CONDITIONING SYSTEMS

In Houston,
St. Louis, New York...

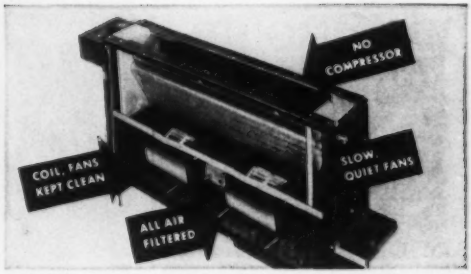
G-E Personal Weather Control

is saving space, cutting cost

SHERATON HOTEL IN ST. LOUIS installed a G-E Personal Weather Control System in 1949. Expressing "complete satisfaction," Sheraton Corporation has since installed these systems in its hotels in many other cities. Units in unoccupied rooms can be shut off, saving power cost. They filter air, keeping coils clean and at top efficiency. Air conditioning contractor: Natkin and Company.

LUXURIOUSAPARTMENTS now being built at Sutton Place South, 53-54 Sts., New York City, will give tenants individual climate control with over 1200 G-E room units. General contractor: Paul Tishman Company, Inc. Architect: Arthur Weiser. Consulting engineer: Rutherford L. Stinard. Air conditioning contractor: Raisler Corp.

COMPACT, 9-INCH DEEP UNITS in each room take little space, yet circulate air gently through large area. Units are supplied with attractive cabinets (above) or without cabinets for concealed applications. Simple pipe runs circulate chilled water for summer air conditioning, hot water for winter heating. Windows are never blocked.



EXTRA-EFFICIENT, QUIETER! G. E.'s room units filter all air, protecting coils from dust and dirt which cut efficiency drastically. Filter replacement takes less than a minute—it's much simpler and cheaper than costly coil cleaning. G-E units are quiet! There's no compressor in the room unit, just the quiet G-E motor and velvet-smooth, low-speed fans.

Consider how G-E Air Conditioning can make your building more profitable

Because space means money in both new and existing buildings, General Electric Personal Weather Control Systems have been designed for installation with small-size, space-saving ducts or no ducts at all.

These extremely flexible systems heat in winter and cool in summer. Individual room air conditioners (shown above) are supplied with chilled or hot water through simple pipe runs from a central source.

In new buildings, such as the apartments at Sutton Place South, 53-54 Sts., (at left) New York, the use of wall apertures for ventilation eliminates the need for ductwork and cuts installation cost. In existing buildings such as Houston's Sterling Building and the Hotel Sheraton in St. Louis, adaptability of ventilation methods to individual needs avoids the necessity of building alterations.

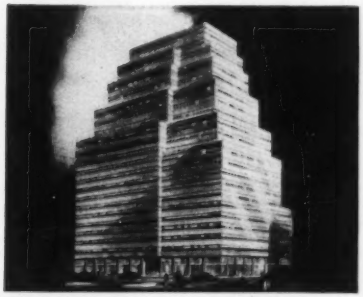
Flexibility Means Economy...Future space rearrangement is simplified by the use of G-E room units because of their flexibility in capacity. G-E Air Conditioning pays off in operating cost reduction, too. During periods of system start-up or reduced occupancy, the room units can be operated without the expense of running central ventilation equipment. Units in unoccupied rooms can be shut off. G-E systems often require less compressor capacity, saving both installed and operating cost.

Building Value Increases...Tenants enjoy living or working where they get individual finger-tip control of climate without disturbing other rooms. Greater tenant satisfaction means lower turnover, more profitable occupancy.

Cuts Maintenance Cost..."Never had to replace one," says Clay J. Berry of the Fair Building, Fort Worth, Texas, where 500 G-E room units have been in use since 1939.

"Maintenance cost has been no factor, and operating cost has been surprisingly low," says E. F. Puls, National City Building, Dallas, Texas.

Owner satisfaction like this is one of the reasons why G-E Personal Weather Control is going into buildings like New York's new Dun and Bradstreet Building...12 Sheraton Hotels...and banks, hospitals, and other structures in many parts of the country.



NEW G-E CENTRAL PLANT SYSTEM for New York City building. The beautiful new 25-story office building at 575 Madison Avenue uses 43 G-E large-space air conditioners. To save ductwork, units are installed on all floors. General contractor: Uris Brothers. Architect: Emery Roth & Sons. Consulting engineer: Rutherford L. Stinard. Air conditioning contractor: Raisler Corp.

See our catalog in Sweet's

FREE! Data on G-E Air Conditioning Systems.

GENERAL ELECTRIC COMPANY,
Air Conditioning Department, Sec. HP-8,
Bloomfield, N. J.

Please send me without obligation detailed information on

☐ G-E Personal Weather Control
☐ G-E Central Plant Air Conditioning

NAME.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

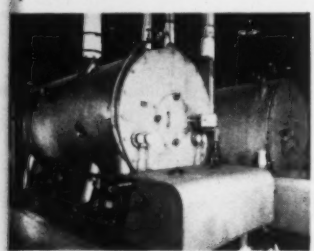
GENERAL ELECTRIC

Steam Generators Pay for Selves and Save $10,000 in First Year

Operating Costs Reduced Sixty-Six % With Lower Fuel Cost & Maintenance

Many railroads have effected huge savings by replacing old inefficient boilers with modern packaged automatic steam generators. Mr. O. T. Carroll, Chief Engineer of Peoria & Pekin Union Railway Co., Peoria, Ill., purchased for his company two modern packaged steam generators; a 75 h.p. for stand-by and a 150 h.p. "on-the-line", and reports his savings as follows:

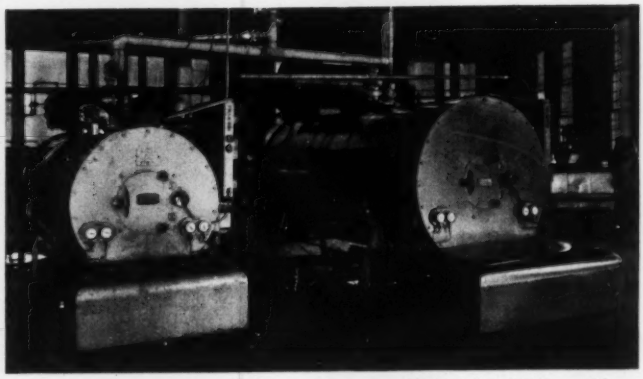
"The operation of the two York-Shipley Steam-Pak Generators installed in our roundhouse to furnish steam for heating the roundhouse and offices is beyond our expectations as to expense and efficiency. The savings effected in changing from the operation of the old coal-fired boiler will pay for the cost of installation and the first year's operation."



The total investment for these two new generators, fired with low cost Bunker C heavy fuel oil, was approximately $35,000.00. Cost of fuel and maintenance annually was reduced to approximately $8,000.00—a 66% reduction, based on the average operating cost of the old plant of $53,000.00 per year.

Maintenance cost old boiler	$53,000.
Cost of new equipment	35,000.
Operating cost new equipment	8,000.
Total cost first year	$13,000.
First year's savings	$10,000.
Estimated 2nd. year savings	$15,000.

These modern Steam-Pak Generators, manufactured by York-Shipley, Inc., York, Pa., are showing similar savings in hundreds of installations all over the country.



Multiple installation at Monon Railroad, Indianapolis, saves $1,000.00 per month in fuel and labor.

STEAM-PAK YORK POWER GENERATOR
A PRODUCT OF YORK-SHIPLEY

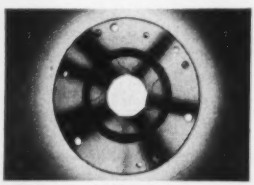
SAVE MONEY

They're Built For Maximum Efficiencies

In Operation . . .

- Engineering design recognized by top engineers and architects.
- Satisfactory operation in thousands of buildings all over the country.
- Tremendous savings proven by hundreds of case histories.
- Distributors chosen for their engineering ability, trained to provide the best engineering "know-how."

These are four basic reasons why Steam-Pak should be No. 1 on your list of steam generators.
See your nearest York-Power Distributor or write York-Shipley for complete details.



IRIS SHUTTER
Patent protected feature provides precision control of burner air, accurately synchronizing air-oil adjustment.

NEW FIRE CONTROL
Swirling flame action speeds gas flow, increasing heat absorption and combustion efficiencies.

Steam-Pak Generators — from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil or straight gas.

YORK SHIPLEY
534 JESSOP PLACE · YORK, PENNSYLVANIA · PHONE 7861
Industrial Division

We have been asked:

"What is the best insulation for process lines which must be taken down for occasional cleanings?"

An engineer writes—"We have several hundred feet of process lines which must be taken down every few months for cleaning. These lines operate at a temperature of about 500° F. Which kind of pipe insulation do you recommend for this type of service?"

In this case, we suggested Bestfelt insulation for the lines.

This highly efficient pipe insulation is constructed of built-up layers of crimped asbestos papers having approximately 33 layers per inch of insulation thickness. This construction gives Bestfelt covering unusual strength and high resistance to breakage when the process lines are occasionally taken down and cleaned.

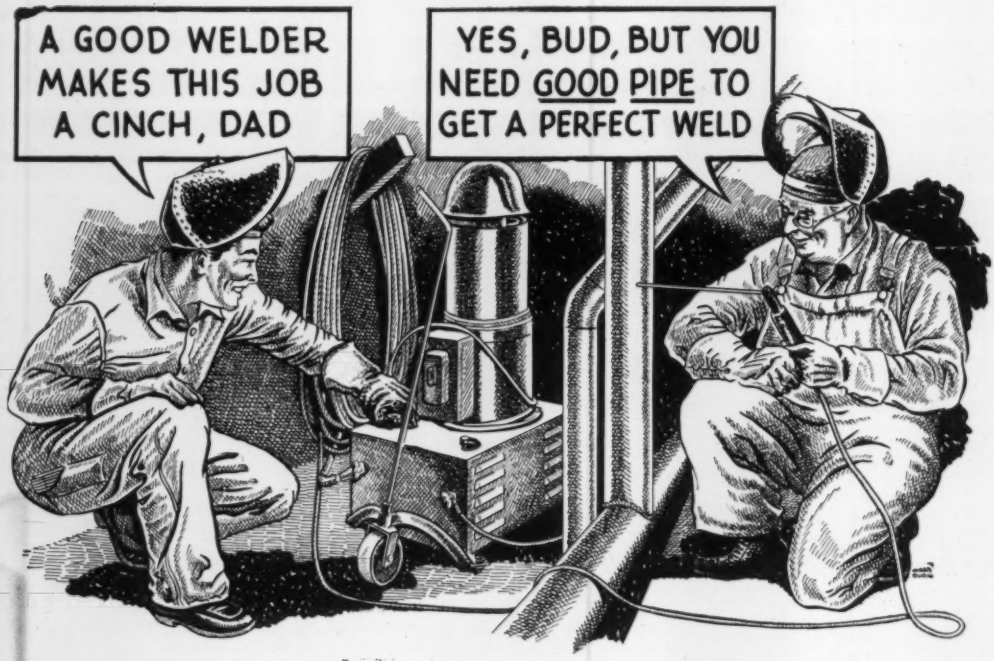
This insulation also is an excellent material for fabrication of flange or other fitting covers which must be removed and replaced frequently. In addition, it will withstand vibration better than other types of insulation recommended for use in its temperature range.

Bestfelt can be wired in place over the line, then covered with rosin-sized paper and sewed or pasted canvas. The insulation need not be removed each time lengths of pipe are taken down for cleaning.

Helping you arrive at the most practical solution to any insulation problem is part of the day-to-day job of Armstrong engineers. The next time you're up against a problem call in one of these men. Just get in touch with the Armstrong office nearest you.

SEND US YOUR QUESTIONS: If you have any questions on the use or application of either high- or low-temperature insulation, please do not hesitate to write to us. We'll do our best to give you a prompt and practical answer. Just address a letter or post card to Armstrong Cork Company, 4405 Maple Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS



Good welder + good machine + GOOD PIPE = GOOD JOB!

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

No matter how intricate the weld, you do it readily with Youngstown pipe. That's because Youngstown pipe is designed and made for easy welding--truly round, uniform in wall thickness, uniformly sized, and chemically and metallurgically right. The name "Youngstown" rolled into a length of pipe means it is GOOD PIPE.

QUALITY YOUNGSTOWN SERVICE

Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

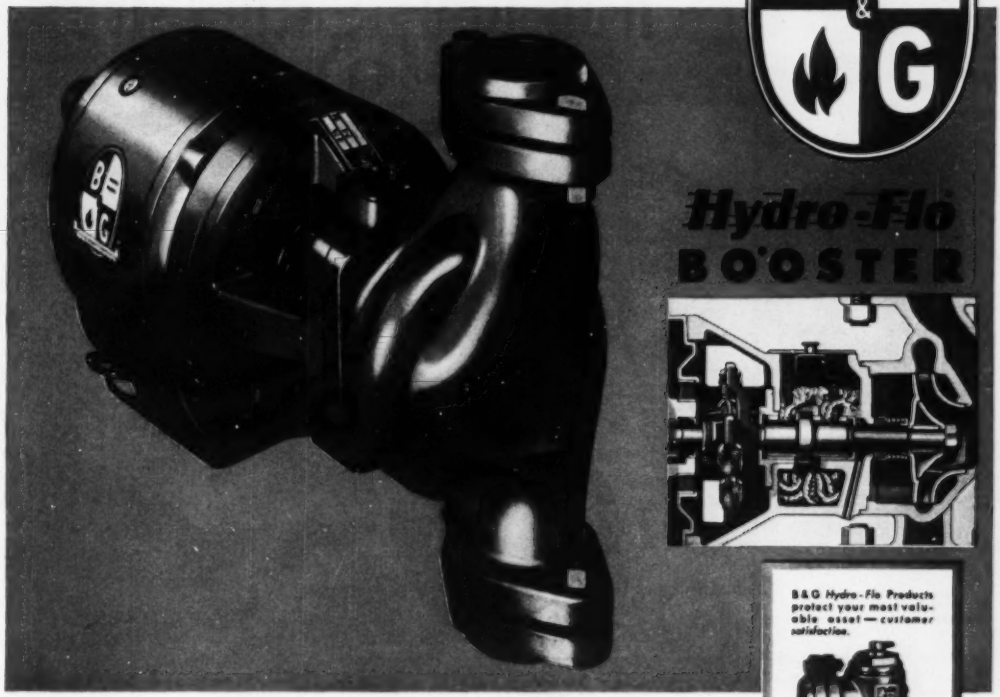
Export Office-500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - HOT AND COLD FINISHED CARBON AND ALLOY BARS - RODS - SHEETS - PLATES - CONDUIT - RAILROAD TRACK SPIKES.

YOU CAN DO A *BETTER* JOB WITH A

B & G

Hydro-Flo BOOSTER



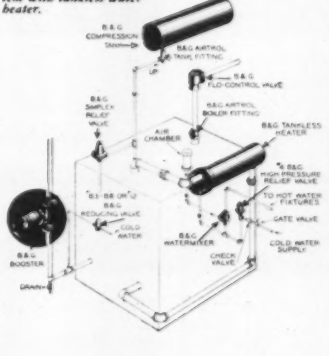
Year after year, more B & G Boosters are installed than any other pump built for the same purpose! This preference is based on the better design and precision workmanship which have produced an amazing record for failure-proof dependability.

The above cross-section of a B & G Booster reveals some of the reasons why this pump is so completely outstanding. Note these features —*compare them:*

1. Spring-type *silent* Coupler.
2. Highly polished, score-proof steel Shaft, with integral, electronically hardened thrust collar.
3. Diamond-bored bronze Bearings, made extra-long for quiet, long-lived operation.
4. Genuine *oil-circulating* lubrication system.
5. Water-tight Seal prevents water leakage into bearings—protects against emulsification of oil.
6. Impeller has true centrifugal construction—closely fitted to prevent water slippage.

If ever necessary, the B & G Booster is easily serviced. Johannson gauges are used throughout in construction and assembly, assuring positive accuracy of fit and complete interchange of parts from one pump to another.

Typical installation of single zone B & G Hydro-Flo Heating System with tankless water heater.



B&G Hydro-Flo Products protect your most valuable asset — customer satisfaction.

B & G Flo-Control Valve

B & G Monoflo Fitting

B & G Relief Valve (ASME Stamped)

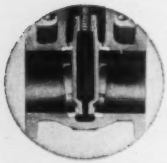
B & G Deluxe Tankless Heater

BELL & GOSSETT
COMPANY

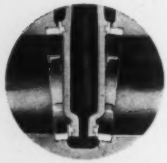
Dept. CA-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Road, Toronto, Canada

*Reg. U. S. Pat. Off.



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

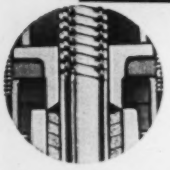
WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

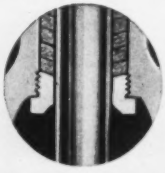
WALWORTH

valves and fittings

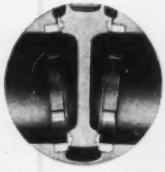
60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

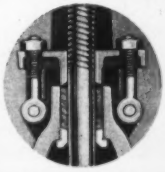
T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



Bronze Back-Seat Bushings in bonnets of OS&Y valves.



Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

Seeking help in fabricating tubular parts?

If you are now called upon to supply tubular parts fabricated of non-ferrous tube, look in on the specialized facilities available to you here at Wolverine.

Regardless of how you may be set up for producing the parts you contemplate, you'll find it a definite advantage to consider Wolverine's skill and knowledge of fabrication.

You have at your command over three decades of tube-manufacturing and related fabrication experience that can help you immeasurably.

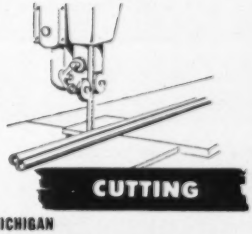
We can supply the complete tubular parts or show you the most efficient ways of fabricating the parts in your own plant.

The illustrations here suggest only a few of the many operations that we are particularly equipped to render assistance to you.

WOLVERINE TUBE DIVISION

Calumet and Hecla Consolidated Copper Company
INCORPORATED

Manufacturers of seamless, non-ferrous tubing



WOLVERINE TUBE DIVISION, 1419 CENTRAL AVENUE, DETROIT 9, MICHIGAN

Plants at Detroit, Mich. and Decatur, Ala.

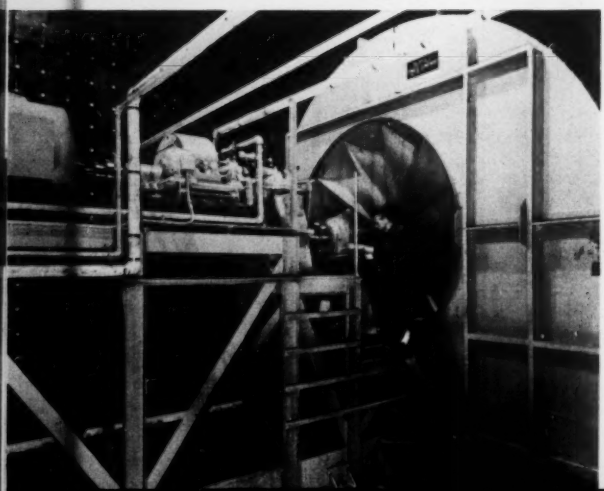
Wolverine Mill Depots:
DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
LONG ISLAND CITY, N. Y. • PHILADELPHIA, PA. • PROVIDENCE, R. I. • ST. LOUIS, MO.

Sales Offices in Principal Cities

Export Department 13 E. 40th St., New York 16, N. Y.

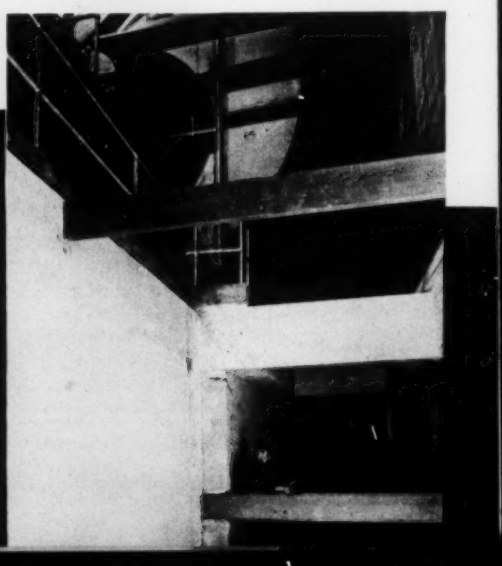
GIVE AIR A *Fast*

— as KAUFMANN'S SHOPPERS ENJOY "RESORT" CLIMATE IN ALL 13 STORIES OF PROMINENT PITTSBURGH STORE



DELIVERING 15 TONS OF AIR EVERY MINUTE!

The first air conditioning installation utilizing the high duct velocity principle for large interiors. More air thru smaller ducts at faster speeds saves space and money. Designed and installed by The Carrier Corporation, this installation is already highly regarded in the department store field.

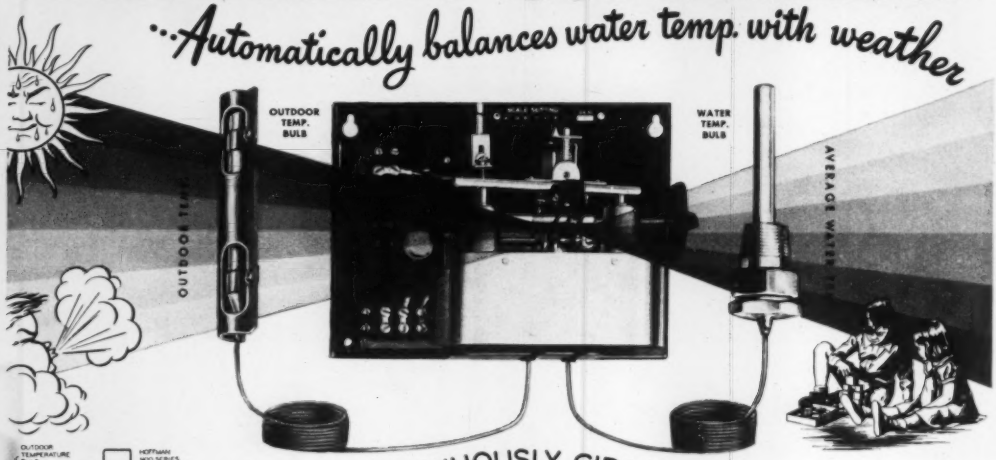


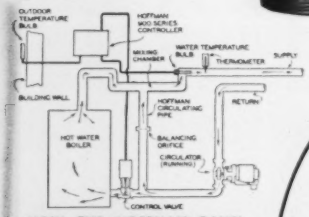
Ride

"Buffalo" CAN SOLVE YOUR AIR PROBLEM!

PANELMATIC CONTROLLER

...Automatically balances water temp. with weather





HOW THE HOFFMAN PANELMATIC SYSTEM COMBINES CONTINUOUS CIRCULATION WITH WATER TEMPERATURE CONTROL

CONTINUOUSLY CIRCULATED HOT WATER SYSTEM

Designed especially for AUTOMATIC HOT WATER

The Hoffman Panelmatic Controller is based on the fact that for every Outdoor Temperature there is a corresponding Supply-water Temperature, which must be *automatically maintained* in the heating units. The correct Supply-water Temperature, in the case of a panel heating system, or the output per sq. ft. EDR in the case of other forms of radiation, must be specified by the Architect or Engineer for *one Outdoor Temperature*. The Controller then *automatically* adjusts the Water Temperatures to balance any other outdoor conditions encountered. The following table illustrates several sets of conditions for a panel heating system.

Architect or Engineer to Specify			Factory Sets Controller		Controller Automatically Furnishes Supply Water at Temperatures Correct for Any Outdoor Temp. as Listed Below				
					Outdoor Temperature °F.				
Design Temp. °F.	Supply Water °F.	Room Temp. °F.	Scale No.	Supply Water °F. at Outdoor 32 °F.	−10	0	+10	+30	+50
					SUPPLY WATER TEMPERATURE °F.				
−10	150	70	11	108	150	140	130	110	90
0	150	70	13½	114	—	150	139	116	94
+10	140	70	14	115	—	—	140	117	94
−10	140	70	9	104	140	132	123	106	88
−10	160	70	13	113	160	147	137	115	92

When the outdoor temperature reaches 65°F., the Circulator automatically stops. The 65° factory setting was chosen because it is the basis for calculating degree days. If a different cut-out temperature is desired, it can be easily adjusted to individual requirements. Occasionally the actual heat loss differs from the calculated loss due perhaps to changes in construction. The Panelmatic Controller can be easily re-adjusted after installation according to simple, definite instructions furnished by the factory. Technical literature describing the Panelmatic System and sample specifications, gladly furnished on request.

HOFFMAN SPECIALTY COMPANY, Dept. PG-5, 1001 York St., Indianapolis 7, Ind.

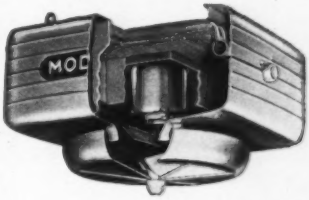
PIONEERED BY HOFFMAN

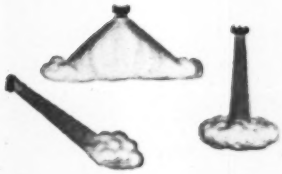
HOFFMAN PANELMATIC

It pays to look for these clues when selecting Unit Heaters

EXAMINE CONSTRUCTION

Modine Unit Heaters are designed and built to give long-term, trouble-free service. Steam-carrying passages are corrosion-resistant. Cylindrical tubes and headers are brazed at the joints for extra strength to resist pressure. Individual expansion bends absorb differential stresses. Parker-Bonderizing protects casings against rust.





EXAMINE PERFORMANCE

Top heating performance — that's what you get with Modines, whether you specify the *Horizontal*, *Vertical* or *Power-Throw* model. Uniform comfort is assured because Modine Unit Heaters have the correct combination of outlet air temperature, volume and velocity.

EXAMINE ECONOMY

Excellent heating performance at *minimum cost* . . . that's another big bonus Modines give you! Impartial tests prove that Modine Unit Heaters save up to 25% in fuel costs over direct radiation under identical operating conditions. And by operating only the fans, Modines provide economical, refreshing air circulation, in spring and summer.

Consider the evidence and you'll want Modine

Check all the angles before you buy — and you'll select Modine Unit Heaters. In factories, shops, stores — wherever Modines are used, they establish an outstanding reputation for trouble-free service. Your nearest Modine representative will gladly give you more facts. Or write direct. Modine Mfg. Co., 1509 Dekoven Avenue, Racine, Wisconsin.

Ask for Modine Unit Heater Bulletin 149A. Also available — bulletins covering special applications in commercial brooder houses, greenhouses and milk houses.

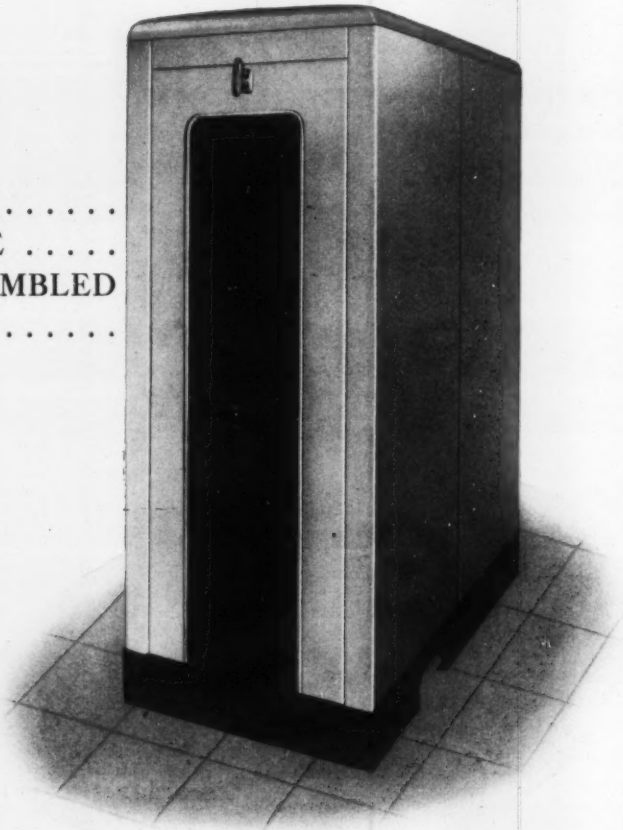
U-1099

Modine UNIT HEATERS

FOR FACTORIES • STORES • GREENHOUSES • COMMERCIAL BROODER HOUSES • MANY OTHER APPLICATIONS

Designed by Atlas...

STURDY . . . . . .
WELL MADE . . . . .
EASILY ASSEMBLED
BEAUTIFUL . . . . . .



Enhance your boiler · · · Enlarge your market with a boiler jacket by Atlas

These days a boiler jacket is more than just a necessary protective covering for your product. Properly designed, it is a means of attracting more prospects, creating more sales, and making both the sale and the installation easier and less costly than ever before.

Beautiful Atlas boiler jackets are designed exclusively for you—tailor-made to fit your market—built to your own boiler specifications. Remember—the average buyer takes performance for granted . . . bases his final choice on appearance.

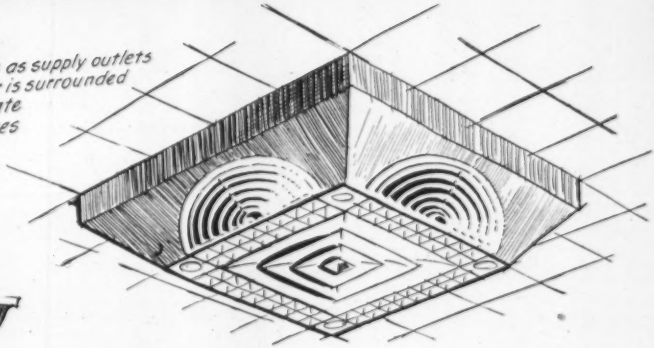
Send your boiler specifications to us for cost estimates.

Also Manufacturers of Furnace Casings and Blower Housings

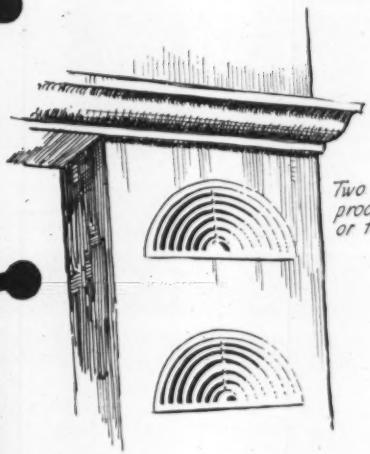
Atlas MANUFACTURING CO.

EUSTIS AT ROBBINS STREET • SAINT PAUL 4, MINNESOTA

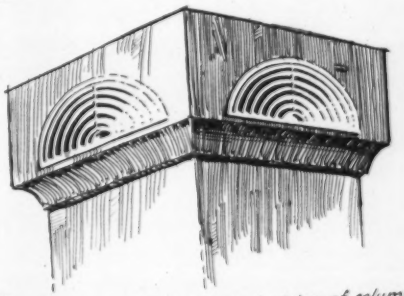
ideas for using ANEMOSTAT AIR DIFFUSERS



Type W Anemostats as supply outlets
Type E for return air is surrounded
by narrow egg crate
fluorescent fixtures



Two Type W's at side of
procenium arch for auditorium
or theatre installation



Remember – pattern control can easily
be obtained with standard Anemostat
Air Diffusers

Type W's used at top of column
which conceals air duct

Anemostat Air Diffusers offer unlimited design possibilities. They can be used in regular, acoustical and egg crate ceilings . . . combined with all types of lighting fixtures . . . in commercial, industrial and home applications. Anemostat Air Diffusers provide uniform diffusion throughout the entire conditioned area. They eliminate harmful drafts, stale air pockets and equalize temperature and humidity. New Selection Manual contains complete application and specification data. Write for your copy.

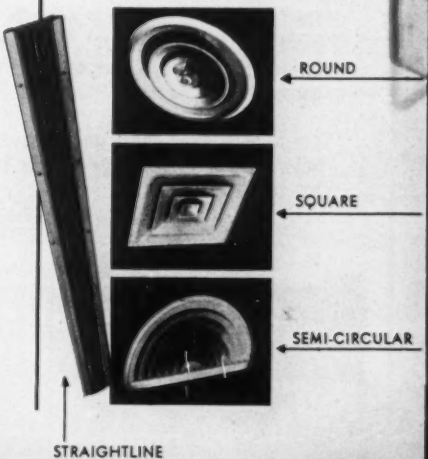
"No air conditioning system is better than its air distribution"

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA, 10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

ANEMOSTAT offers maximum design possibilities because only Anemostat Air Diffusers come in all these shapes



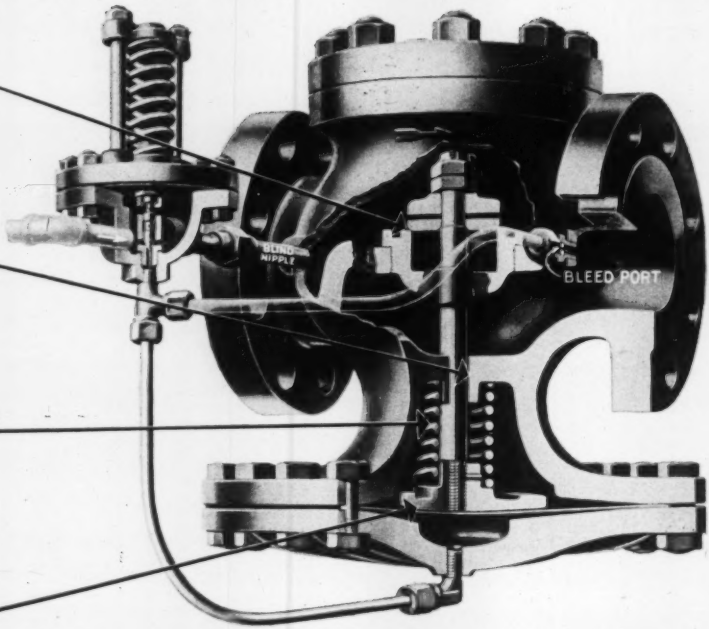
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

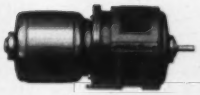
SE-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

American Blower—a time-honored name in air handling

Venturafin
Unit Heaters

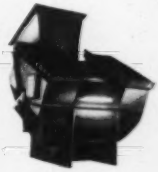


Type TM
Gyrol Fluid Drives

Utility Sets

Ventura
Ventilating Fans

Dust Collectors



Mechanical
Draft Fans

Industrial Fans

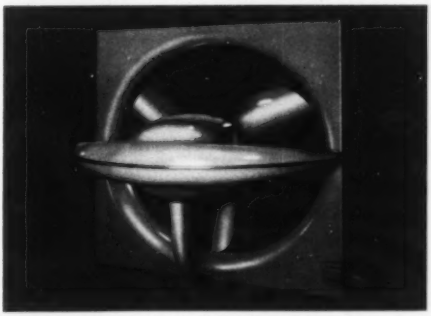
Heating and
Cooling Coils

Air Conditioning
Equipment

If you look before you buy, we're certain you'll buy American Blower Air Handling Equipment. There's a vast difference in quality, design, quietness, operating costs and efficiency. Buyers' tests prove the superiority of American Blower products.

In the San Francisco area, for air handling data call American Blower—Sutter 1-1024. In other areas consult your phone book. NOTE: To better serve our western customers American Blower has built another new plant—conveniently located in San Leandro, California.

Product of the month



American Blower Model A Ventura Ventilating Fan. 12 Sizes. Capacities from 1000 cfm to 9700 cfm, free delivery.

Good ventilation is good business!

Considering ways to step up sales? Thinking of improving working conditions in your plants and offices?

An excellent way to accomplish these aims is to improve the ventilation in your business. That's why we suggest you investigate the advantages of American Blower Ventura Fans this month.

American Blower Ventura Fans are attractively streamlined propeller fans with smooth flowing lines that harmonize well with modern business interiors. A square mounting panel makes the Ventura Fan easy to install, and wiring is fully enclosed for safety.

All Ventura Fans are sound rated and carry Certified Ratings in accordance with the Standard Test Code as adopted jointly by the N.A.F.M. and the A.S.H. & V.E.

You can get full details from your contractor or the nearest American Blower Branch Office. Ask for a free ventilation survey now!

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

SLEEVOIL

-the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

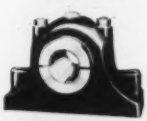
DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on *modern* power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your local classified phone book.

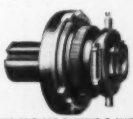
FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS



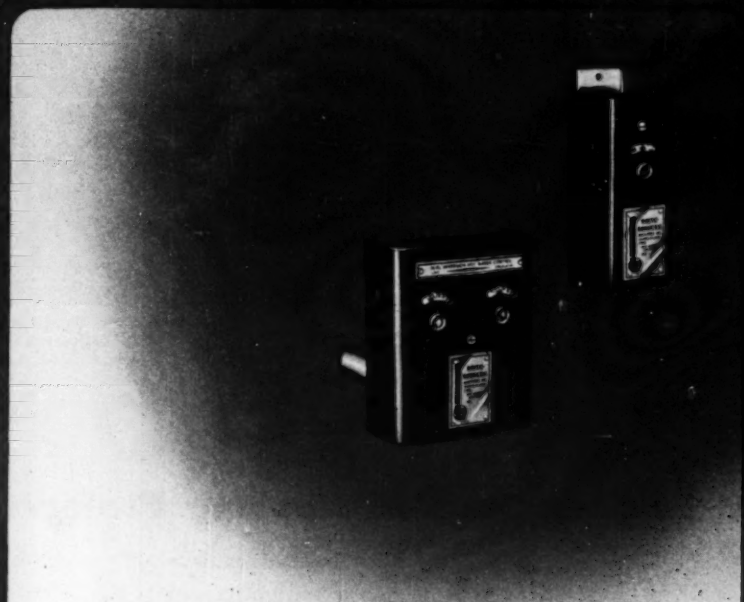
DODGE-TIMKEN PILLOW BLOCKS



ROLLING GRIP AND DIAMOND D CLUTCHES

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS



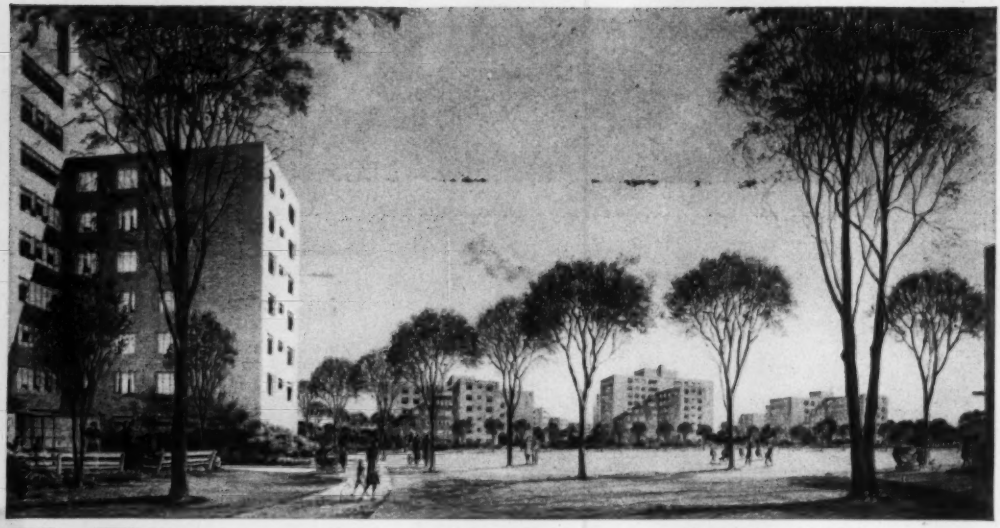
Hot-Water Controls

Available in single units or combination types providing two independently operating controls in a single compact case. Immersion and strap-on types, with angle or vertical well. Hydraulic-Action elements give quick response, positive accuracy and constant differential. Two of many in the comprehensive line of White-Rodgers automatic controls for residential heating. *Write for complete heating control catalog.*

WHITE-RODGERS

WR Controls

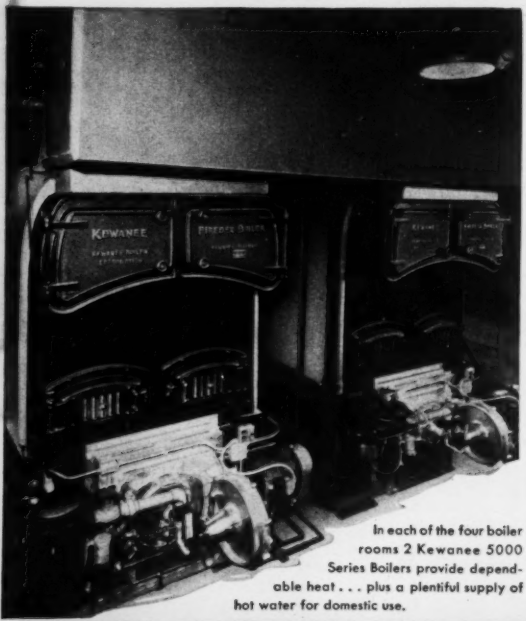
FOR REFRIGERATION HEATING AND AIR CONDITIONING



Dearborn Homes, Chicago Housing Authority—
Loebl, Schlossman & Bennett, Architects;
Robert Gordon, Inc., Heating Contractor;
Samuel R. Lewis & Associates, Mech. Eng.

KEWANEE
STEEL BOILERS

Cut Heating Costs in Housing Projects



In each of the four boiler rooms 2 Kewanee 5000 Series Boilers provide dependable heat . . . plus a plentiful supply of hot water for domestic use.

The Dearborn Housing Development, Chicago is an excellent example of the remarkable progress being made in "homey," economical mass housing.

Built in four separate units with one, two and three bedroom apartments, the project accommodates 800 families. And, *although designed for low rentals*, the buildings include such refinements as modern heating with wall hung convectors and fin type radiators.

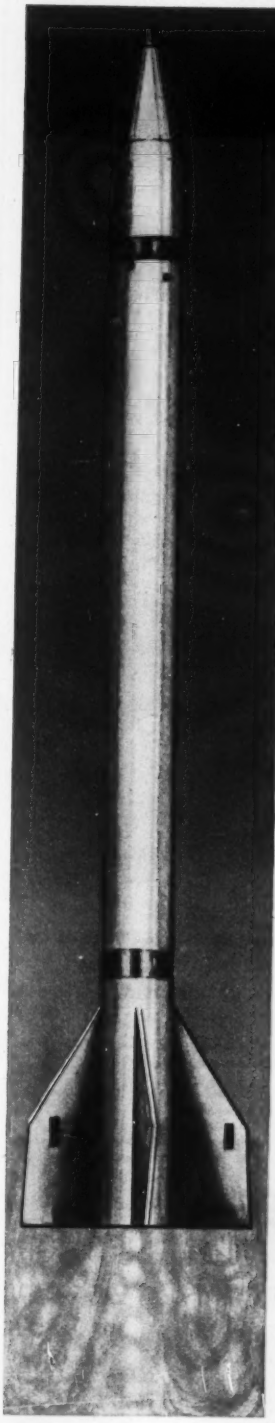
Each of the four units is complete in itself with its own boiler room in which *2 Oil Fired Kewanee Boilers* produce heat at the rate of 7 million Btu hourly . . . ample capacity to provide heat plus an abundance of hot water for kitchen, laundry and bath.

Because of their long standing reputation for producing heat economically, Kewanee Boilers were the logical choice for Dearborn Homes as they are for many other important housing projects throughout America.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

BUILDING BETTER BOILERS OVER 80 YEARS

Serving home and industry
AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



MODERN

Improved

LEVEL-TROL®

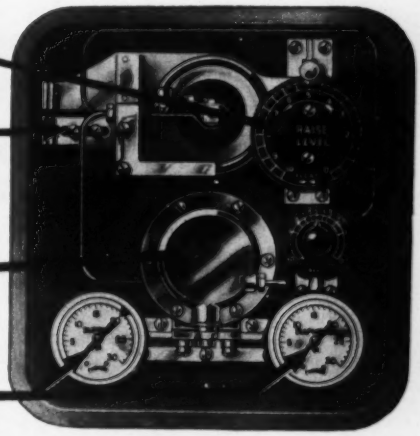
FOR LIQUID LEVEL CONTROL TRANSMISSION and INDICATION

Improved Feature
New level set adjustment. More highly visible.

Improved Feature
New factory calibrating adjustment makes possible accurate setting of proportional range over full float length.

Improved Feature
New relay—more compact—easily removed—easily assembled.

Improved Feature
Operating medium and diaphragm pressure gauges are glass-enclosed.

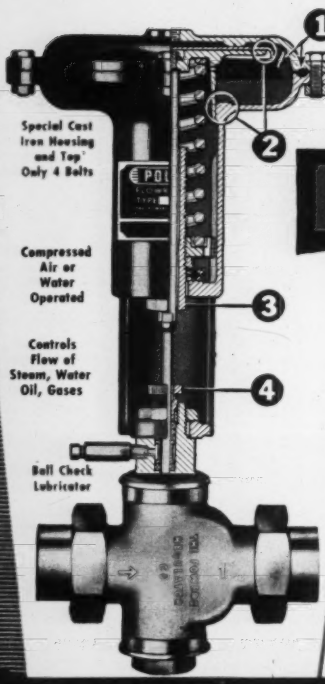


Type 2500-249
Level-Trol

• This improved Fisher Series 2500 Level-Trol is designed to better meet the requirements of field service—to give longer life—ease of maintenance. It still combines proportional range and specific gravity setting in one simple adjustment. Die cast weather—proof pilot case with black enamel finish, and improved lock hasp. Series 2500 Pilot Assembly is interchangeable with Fisher Series 2405 Pilot Assemblies now in service.

FISHER GOVERNOR CO.

MARSHALLTOWN, IOWA



POWERS FLOWRITE VALVE

VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

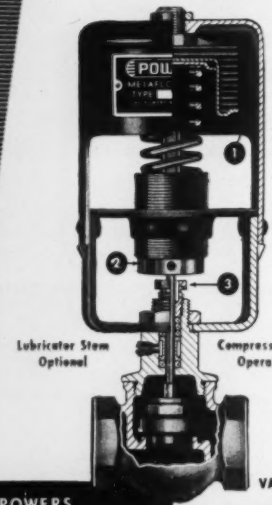
ADJUSTING SCREW—Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

BONNET ASSEMBLY—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES—Sizes ½" thru 8"—For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

POWERS BETTER Valve Tops

Packless Valves Available



POWERS METAFLOW VALVE

VALVE SIZES— ½" thru 2"

Bronze bodies, screwed ends. Rugged construction to withstand piping strains.

POWERS *Metaflow Valves* are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

1. **HOUSING**—High strength aluminum alloy. Hydraulically formed long life brass bellows provides smooth and powerful stroke.

2. **ADJUSTING SCREW**—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.

3. **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

TRIM—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam.

Phone or Write Nearest Office for Prices

THE POWERS REGULATOR CO.

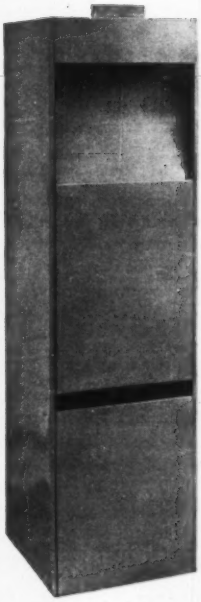
OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2720 Greenview Ave. • **NEW YORK 17, N.Y.**, 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • **TORONTO, ONT.**, 195 Spadina Ave.
MEXICO, D. F., Edificio "La Nacional" 601

OVER 58 YEARS OF PNEUMATIC TEMPERATURE CONTROL

(PM3)

– Forced Air Type –
TWO MODELS AVAILABLE



Model HB-110

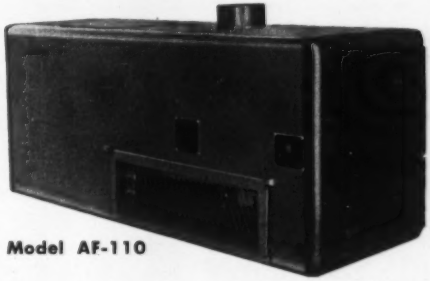
Each John Zink Central Gas Heater is equipped with an automatic safety shut-off that is really automatic.

Here is truly a universal, efficient, simple, and compact CENTRAL HEATING UNIT. Fully automatic, it is a complete packaged unit ready for installation. The two heaters shown are almost identical in operation and design of the heat exchanger. The two different types of casings are furnished to meet requirements for a particular application.

●

Heaters may be installed in the basement, attic, service closet, or utility room of a home. The AF-110 may be installed even under the house if certain provisions are made for the draft diverter. For industrial applications, it may be installed on a shelf or balcony; as a suspended heater and as a duct heater.

The John Zink Central Gas Heater is designed as a winter air conditioner with a summer switch to provide air circulation during warm weather.



Model AF-110

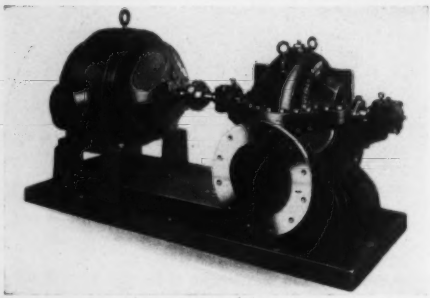
Write for Literature

4401 South Peoria **Tulsa 1, Oklahoma**

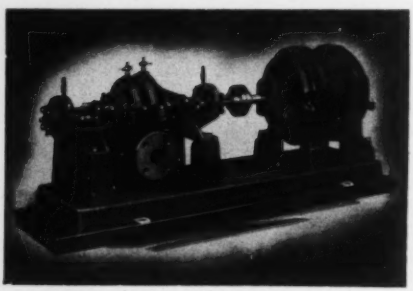
The "LOW-BID" PUMP

isn't necessarily the economical one!

"Buffalo" PUMPS Save Money On The Job —WHERE SAVING COUNTS!



Above, for handling clear water, 10 to 10,000 gpm, you can't beat a "Buffalo" Type "SL" Pump.



For clear water, any temperature, at pressures up to 500 pounds, specify a "Buffalo" Type "RR" Pump.

If the pump has been built down to a price rather than up to a quality standard, chances are that any savings on first cost will be nullified by continual repair and replacement costs.

"Buffalo" Pumps have always been built to save your maintenance men trouble, to keep delivering for a maximum number of years and to use minimum power.

But why not get the construction and performance facts? Write today for Bulletins 955-N and 980-B, and see why "Buffalo" Pumps save money the minute they start on the job.

"Buffalo" PUMPS

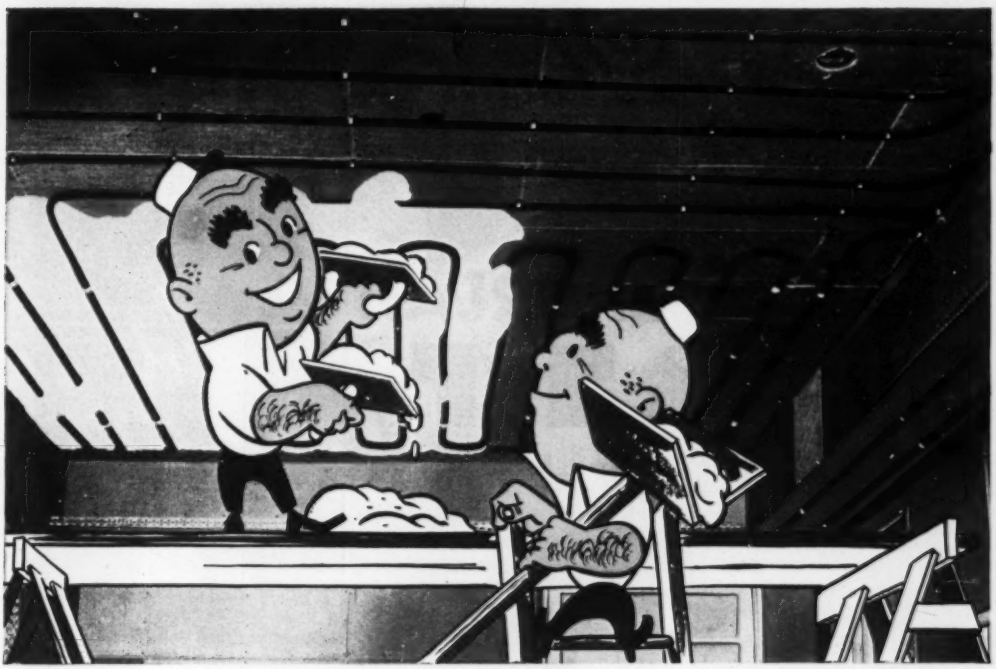
BUFFALO PUMPS INC.

171 MORTIMER ST. BUFFALO, NEW YORK

Canada Pumps, Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



Bundyweld Tubing . . . plays double role in better radiant heating

Handles better at your building site, **Performs** better in your systems . . .

Because Bundyweld is better tubing . . . the only tubing that's double-walled from a single strip, with a patented beveled edge. Copper-brazed through 360° of contact, its walls are safe, solid, strong.

Rugged Bundyweld arrives at your building site (one end expanded if specified) ready to ride right through fabrication steps. One man bends dead-soft Bundyweld on a simple fixture, joins the formed, rigid grids in leakproof union by soft or hard soldering. Just two men position them. There's never a worry about dents or structural collapse.

Performance in your systems is just as smooth. For Bundyweld is scale-free. Water flow stays clean, even, steady. Bundyweld's thinner wall radiates heat faster, more effectively, as well.

Check your *Sweet's Architectural File* for more information. Or write: ***Bundy Tubing Company, Detroit 14, Michigan.*** Whatever your needs, we'll do our best for you, with the understanding, of course, that defense orders must come first.

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

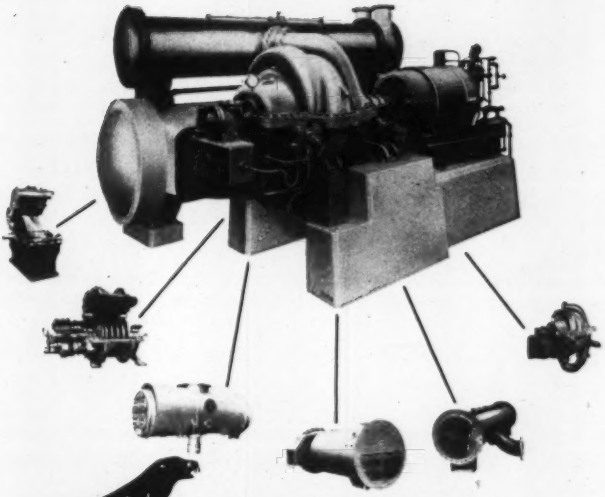
continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

Buy
SPORLAN
TVF
right
down
the
line!



Where do you get

UNDIVIDED RESPONSIBILITY

in an installation of centrifugal refrigeration?

Worthington will "wrap up a package".

Unlike other manufacturers of air conditioning and refrigeration equipment, Worthington *makes*—not just assembles—all the major components for each installation.

Compressor, condenser, cooler and such drive equipment as steam turbines, steam condensers, motors, and step-up gears—are all made in Worthington's own plant—each carefully designed for balanced operation with its companion components.

So the builder and owner can place full responsibility on the one supplier —Worthington.

Worthington centrifugal systems are used with most refrigerants and for any process—chilling water, brine, chemicals, lubricating oils—for temperatures as low as minus 160 F, capacities from 150 to 2600 tons.

A typical Worthington compressor feature is the arrangement of the volute passages and impellers to counterbalance the radial and axial thrusts, respectively, in the various stages.

Write for Bulletin C-1100-B14 on Worthington centrifugal refrigeration.

Worthington room conditioners for both heating and cooling are built to operate with chilled water or direct expansion cooling, capacities from 350 to 600 cfm for under-window installation.

PACKAGE UNITS SELECTED TO COOL HUGE OFFICE BUILDING

This is an excellent example of how Worthington's complete line makes it possible to select exactly right equipment.

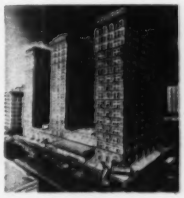
The new office building at 488 Madison Avenue, New York—home of many famous magazines and large industrial firms—is air conditioned primarily by package units, assisted by a Freon-12 reciprocating system with chilled water and steam coils.

Purpose of using package units in a big building like this is to provide for a variety of conditions imposed by both the building and the type of tenants: air conditioning needed only on top floors during certain seasons, difference in sun load on various sections, certain tenants working late hours but only with skeleton forces.

Second through 20th floors are handled by 38 Worthington 20 and 25 ton Package Air Conditioners, two per floor. Basement, first floor and top three floors are handled by two Worthington 75-ton Freon-12 compressors complete with condensers, pumps, water coolers and five central station units with chilled water and steam coils. Total capacity is 1050 tons.

Builders and owners: Ur is Bros. Consulting engineer: Henry Oehrig. Air conditioning contractor: Raisler Corp. All of New York.

RICE HOTEL MULTIPLIES COMFORT-COOLING WITHOUT REQUIRING MORE ROOM



Last year, Houston's Rice Hotel completed air conditioning its entire building, including a thousand guest rooms, dining rooms and meeting rooms, by installing three Worthington 600-ton centrifugal chilled water systems.

This equipment, utilizing Freon-11, replaced ammonia refrigeration equipment having a capacity of 350 tons, yet occupies no more space than formerly.

Worthington equipment was selected primarily because Worthington could provide 100% equipment of its own make. The compressors are driven by Worthington steam turbines and steam condensers.

Engineer: Reg. F. Taylor. Mechanical Contractor: Charles G. Heyne & Co. Architect: Kenneth Franzheim. All of Houston.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

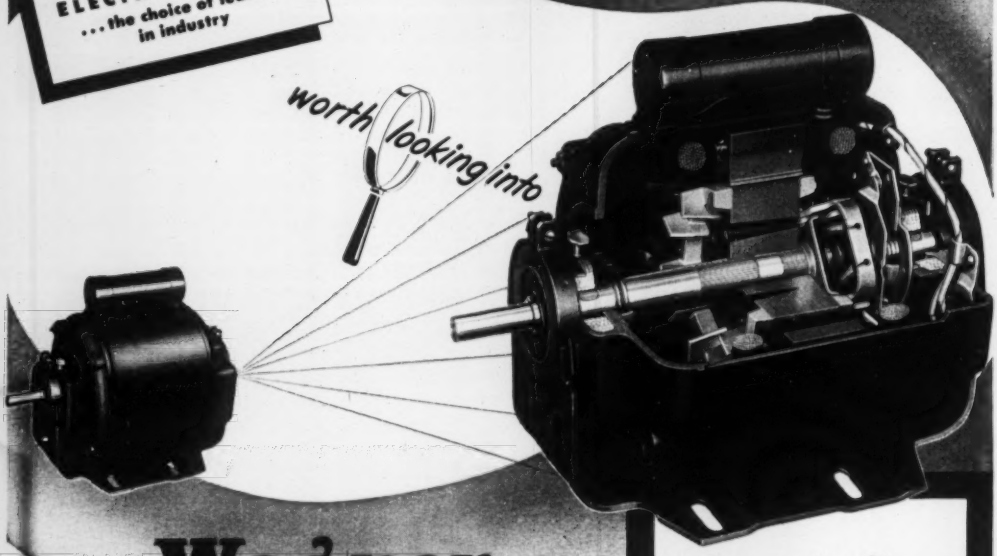
INVESTIGATE

MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A.1.2

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

it pays to be particular about your choice of motors



Wagner
CAPACITOR-START MOTORS

are exceptionally well-adapted to applications with fairly heavy starting loads

The choice of the motor that powers your product is all important. Uniform performance, troublefree long-life operation, a well-known name, and the ability of the manufacturer to provide fast service and repair parts on a nationwide scale, are all factors that add up to satisfied customers for you.

Wagner capacitor-start motors are worth looking into for general purpose applications requiring high starting torque. They are available with sleeve or ball bearings, rigid or resilient bases or a machined end plate for flange mounting. Bulletin MU-185 gives full details—write for your copy.

WAGNER CAPACITOR-START MOTORS...*built in ratings from ½ through 3 hp.*

when you choose Wagner Motors you save time, money, worry because:

1. Improved engineering features assure long life and efficient operation.
2. Wagner Motors are available in a wide range of types and sizes for every application.
3. Wagner Motors are backed by a liberal warranty.
4. They are available from Wagner Branches in all principal cities.
5. More than 650 Wagner Authorized Service Stations and Parts Distributors *plus* 25 Wagner-owned Service Branches provide on-the-spot service, replacement motors, or genuine repair parts.

Wagner Electric Corporation
1891 WE 1951

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

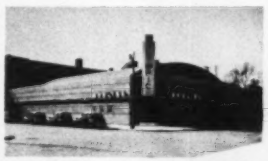
BRANCHES IN 31 PRINCIPAL CITIES

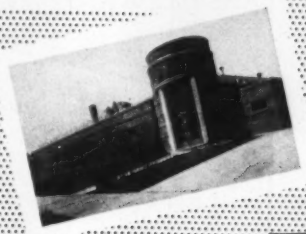
M51-15

JACKSON & CHURCH

warm air heat

Cuts costs . . .
Saves critical materials





Cut the high cost of heating! Compare advantages and savings of Jackson & Church Warm Air Heat against natural convection heat and see why dealers, builders and architects are able to cut costs and conserve critical materials.

In addition to lower installation and operating costs, Jackson & Church Warm Air Furnaces offer many other money-saving advantages. **In most cases, warm air heat PLUS summer air-conditioning can be had for the same approximate cost as convection heating alone.**

Over 100 J-C models are available in a range of sizes from 50,000 Btu to 3,800,000 Btu output . . . designed to provide dependable, healthful heating for every residential, commercial and industrial use.

For the more difficult heating installations, our engineering department is at your service to assist with heating plans. If you are interested as an architect, as a dealer, builder or consumer, write today for further details.

J-C Installations Were Chosen For These Buildings In The Midwest Area

. . . AMERICA'S LARGEST AND MOST COMPLETE WARM AIR HEATING LINE . . .

J-C JACKSON & CHURCH CO.

SAGINAW, MICHIGAN

WORK WELL DONE SINCE '81

Century

Serves the Electric Motor User in Two Important Ways:

1. Century motors are designed and constructed for a long, dependable operating life.

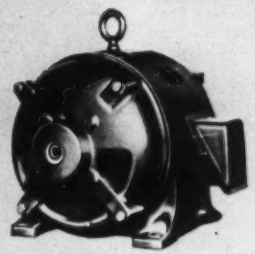
2. Just as important—they are skillfully selected to match the operating characteristics of the many kinds of equipment they drive.

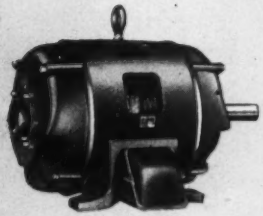
IN CENTURY'S wide range of types and sizes (up to 400 H.P.) there are available: 4 standard classes of starting torque characteristics—6 methods of speed control—constant and short time ratings—4 basic classes of frame protection against atmospheric hazards—a dozen methods of mounting the motor to the equipment—plus many special specifications to meet the requirements of the BIG NAME equipment manufacturers who use Century motors as a component part of their equipment.

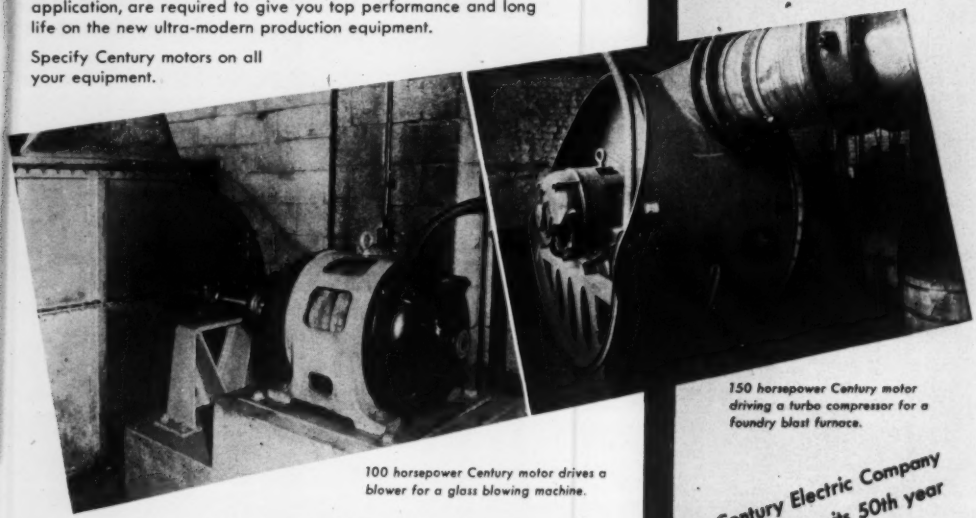
Teamwork with equipment producers gives you skillfully selected motors from Century's wide range of types and sizes... properly applied to match the performance characteristics of the machines they drive.

Both a properly designed and constructed motor, plus skillful application, are required to give you top performance and long life on the new ultra-modern production equipment.

Specify Century motors on all your equipment.







100 horsepower Century motor drives a blower for a glass blowing machine.

150 horsepower Century motor driving a turbo compressor for a foundry blast furnace.

Century SERVICE Is Near Any CENTURY Motor Driven Equipment

Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

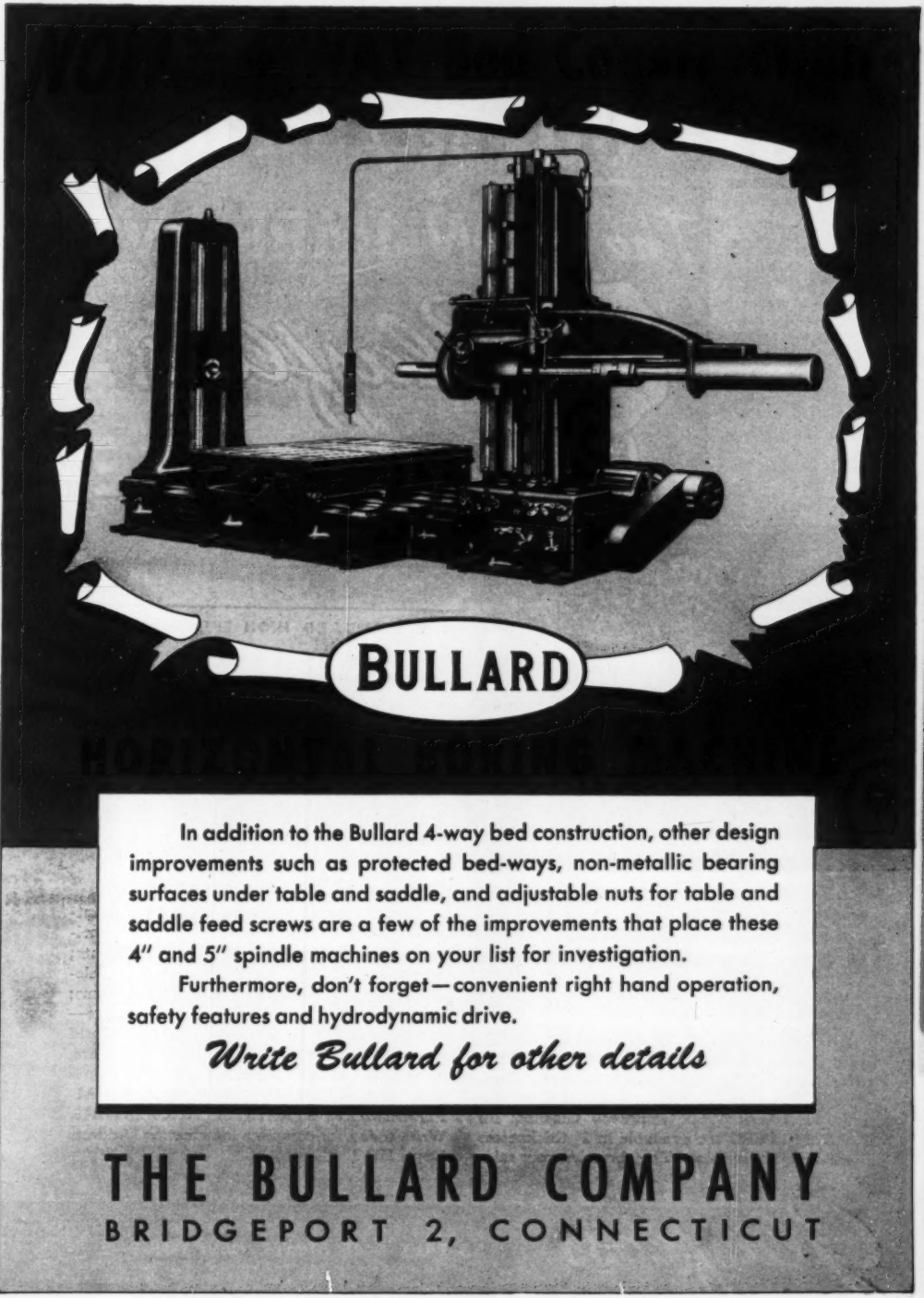
Century Electric Company is celebrating its 50th year in the electrical industry

CENTURY ELECTRIC CO.

1806 Pine St. • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS



In addition to the Bullard 4-way bed construction, other design improvements such as protected bed-ways, non-metallic bearing surfaces under table and saddle, and adjustable nuts for table and saddle feed screws are a few of the improvements that place these 4" and 5" spindle machines on your list for investigation.

Furthermore, don't forget—convenient right hand operation, safety features and hydrodynamic drive.

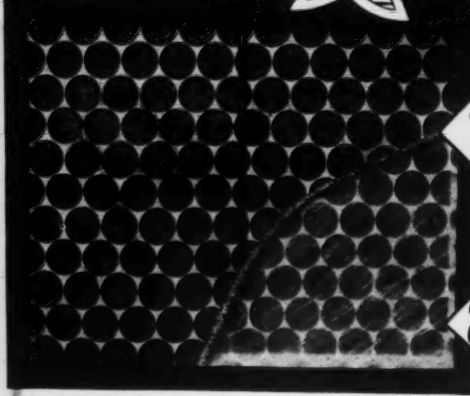
Write Bullard for other details

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

DUST IS OUT BECAUSE IT'S IN*

The NEW IMPROVED Glasfloss AIR FILTER

IMPINGEMENT IS STRAINER



1 THE STANDARD HIGH EFFICIENCY GLASFLOSS AIR FILTER PAD....

PLUS

2 GLASFLOSS STRAINER MAT THAT MAKES DUST FILTERING UP TO 98% EFFICIENT!

* Dust is OUT of the air because it's permanently trapped IN the new, improved Glasfloss I-S (IMPINGEMENT-STRAINER TYPE) AIR FILTER. Higher efficiency factor of 95% to 98%. Resistance, normal.

To the famous, long fine glass fibres of the standard Glasfloss Air Filter pad has been added our exclusive STRAINER MAT feature. Combined, these two elements excel for dust and dirt air filtering. The improved Glasfloss I-S AIR FILTERS are available in 2" thicknesses —in all standard sizes. They broaden your sales opportunity because they are ideal for paint-spray booths in automotive, aircraft and enameling operations; for food processing plants; pharmaceutical and soap manufacturers; television studios; restaurants and dining rooms; hospitals, schools and all public buildings—anywhere in the business and industrial world where clean air is important. Increased profits, more satisfied customers are the plus values you can expect from Glasfloss I-S (IMPINGEMENT-STRAINER) AIR FILTERS. Write today for complete information. Address Dept. HP-3.

Glasfloss 155 EAST 44th STREET, NEW YORK 17, N. Y.

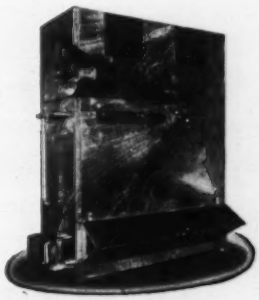
specify ACME

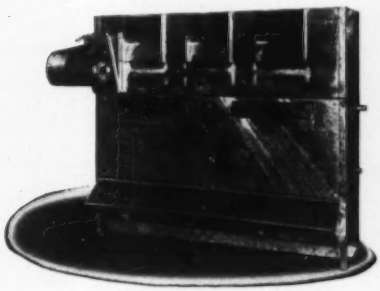
for increased efficiency, economy and long life

ACME Products have been manufactured continuously for more than 30 years. ACME Products are universally accepted and noted for their dependability and fine workmanship. ACME published ratings are accurate and conservative. ACME'S 30 years of engineering experience gives you economy, long life and increased efficiency on which you can build a greater volume of business and increased profits.

EVAPORATIVE CONDENSERS AND HEAVY DUTY COOLING TOWERS

1. Heavier, extra strong construction for durability. **2.** Complete moisture elimination for dry fan operation. **3.** Save more than 90% of the water required. **4.** Built in 3 sections for easy shipment and installation. **5.** Flexible fan arrangement. **6.** Hot-dip galvanized *after* fabrication. **7.** Internally mounted receivers for added storage capacity. **8.** Provision for Micromet threshold water treatment. ALL the above features, with the exception of "internally mounted receivers" and "Micromet threshold water treatment" are also available in ACME Heavy Duty Cooling Towers.





BLO-COLD* INDUSTRIAL UNIT COOLERS

1. Units available for Dry Coil or Brine Spray Operation. **2.** Available for flooded, direct expansion or brine operation. **3.** Coils may be either prime surface or finned; tubes of copper or steel pipes. Fins aluminum or steel. Coils, steel pipes and fins may be hot-dip galvanized. **4.** Vertical or horizontal discharge, easy accessibility to coils. **5.** Economical to operate. **6.** Air inlet front or back.

ACME ALSO MANUFACTURES: Ammonia Condensers ● Freon Condensers ● Shell and Coil and Shell and Tube Condensers ● Dry-Ex* Water Coolers ● Hi-Peak* Water Coolers ● Fin Coils ● Pipe Coils ● Oil Separators ● Liquid Receivers ● Heat Exchangers ● Flow-Cold* Liquid Chillers ● Convectors

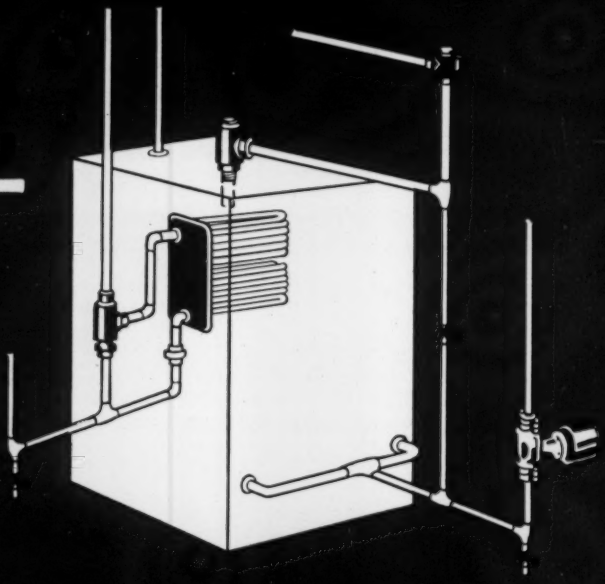
* Trade Mark

MODEL J COOLING TOWERS

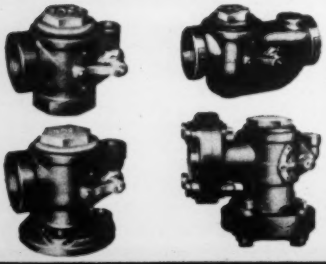
1. Versatile — Model for all purposes. **2.** With or without pump. **3.** An ideal Jobber item, stock model can be used to meet all requirements.

ACME INDUSTRIES, INCORPORATED
JACKSON, MICHIGAN

CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919



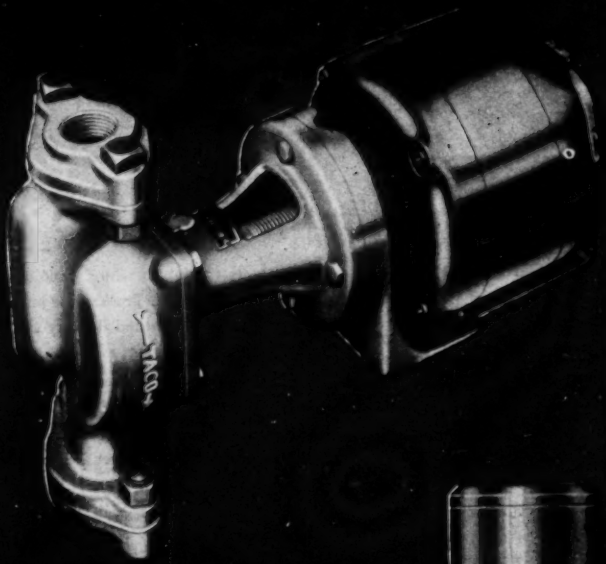
TACO FLOCHEKS



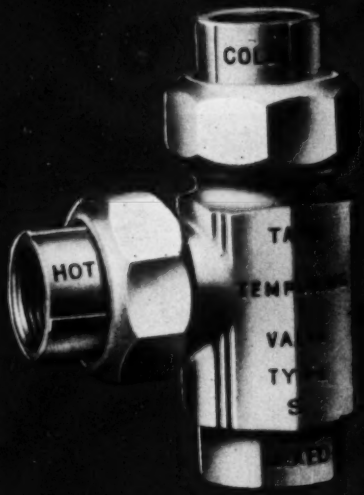
TACO-MATIC VALVE

TACO FLOW REGULATOR

TACO CIRCULATOR

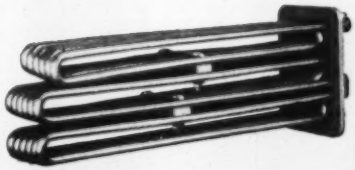


TACO VENT



TACO TEMPERING VALVE

BILTIN TANKLESS TACO



Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

Expansion Joint of the Month

WORLD'S 8 LARGEST JOINTS!

LOW PRESSURE TYPE

The Figure No. 8 Zallea Low Pressure Corrugated Expansion Joint is used to absorb vibration and protect machinery. Made of stainless steel, this joint is of the non-equalizing type and is limited in service to ½" maximum axial movement and 50 lbs. maximum pressure. Furnished with multiple corrugations, it is primarily used on condensers, turbines, stage bleeders, pumps, and between connected equipment where slight movement and

Figure No. 8 Type

vibration occur. Variations of the Figure No. 8 design are available in diameters up to 30 feet in diameter for low and medium pressure service. Where transportation limitations prevent shipment in one piece, arrangements can be made for on site manufacture. These units, like all Zallea Expansion Joints, are produced without circumferential welds in the corrugated element.

. . . a brand new 4-page folder on *all* Zallea Expansion Joints. Send for your copy of Bulletin 351 today!

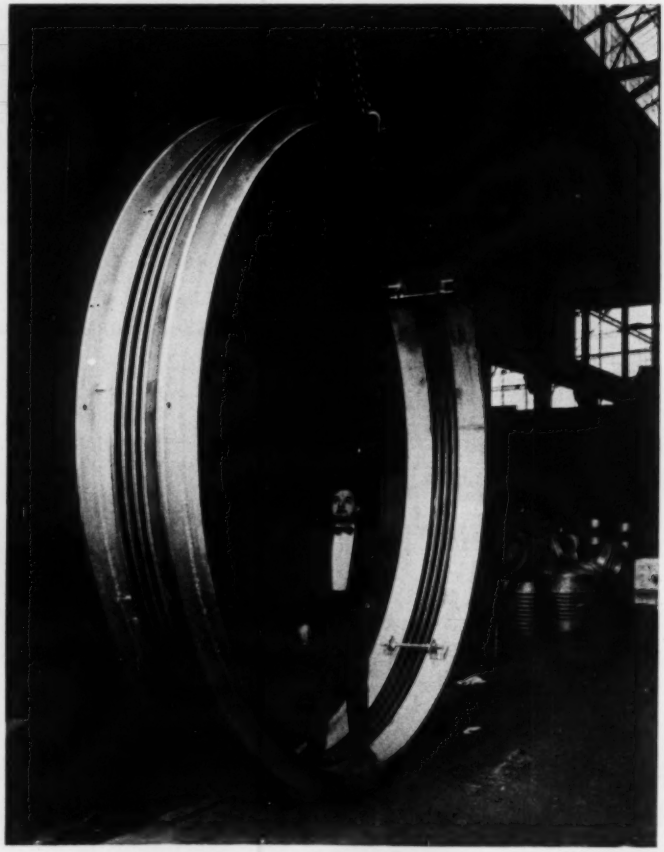
ZALLEA BROTHERS, 816 Locust Street, Wilmington 99, Delaware.

Keeping pace with expanding industrial needs, Zallea Brothers has just completed construction and delivery of the largest expansion joints ever built.

Thirteen feet in diameter, these Zallea Figure No. 8 Stainless Steel Expansion Joints, totaling 8 in number, are installed in a wind tunnel project at Lewis Flight Propulsion Laboratory, NACA, Cleveland, Ohio.

These huge joints are installed in the header between the primary and secondary coolers in the altitude exhaust ducts which convey exhaust gases from full scale thermal jet engines, aircraft engines, turbines, burners and other equipment undergoing tests in simulated altitude conditions.

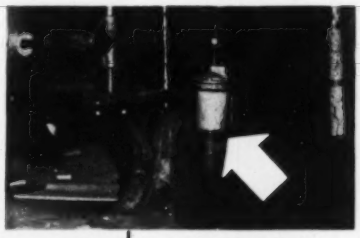
These Zallea Stainless Steel Expansion Joints are used in air service with a working pressure from vacuum to 60 pounds at a temperature between minus 50 to plus 65 degrees F.



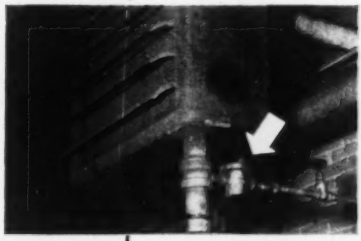
A STEAM TRAP MECHANISM GOOD FOR 900°F, 950 PSIG

. . . will last a long time on low and medium pressures

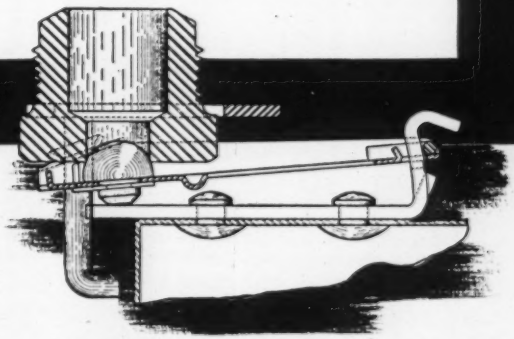
THESE ARMSTRONG USERS KNOW



"TRAPS OPERATE 4 TO 5 YEARS WITHOUT REPAIRS." . . . Weymouth Art Leather Co., South Braintree, Mass.



"50% LESS TRAP MAINTENANCE since installing Armstrongs on low pressure vacuum return heating system." . . . John Deere Ottumwa Works, Ottumwa, Iowa.

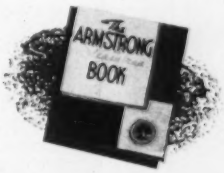


THE valve and seat in *every* Armstrong Inverted Bucket Steam Trap are chrome steel — hardened, ground and lapped to a steam-tight fit. The valve lever assembly and the bucket are corrosion resistant 18-8 stainless. You get the same design, workmanship and materials whether you order traps for a low pressure heating application or for a high pressure power plant application. *In other words, you get the longest-lasting, most trouble-free trap that money can buy at no premium in price.* If you think you'd like that, call your nearby Armstrong Representative for the traps you need now.

ARMSTRONG MACHINE WORKS
874 Maple Street • Three Rivers, Michigan

SEE OUR CATALOG IN SWEET'S

FACTS, FIGURES, PRICES and complete data on trap sizing are contained in the 36-page STEAM TRAP BOOK. Send for your copy.



ARMSTRONG STEAM TRAPS

reasons why

FOR THE MAN WHO HAS TO

install

In designing AAF products, details of installation are given the same careful consideration as performance and maintenance. Simplified installation is an important factor today which means dollar savings in time and labor to the contractor.

Typical examples of attention to installation requirements are the AAF unit filter frame and the Herman Nelson DRAFT | STOP units.

AAF

American Air Filter

COMPANY INC.,

HERMAN NELSON DIVISION

herman nelson

PLANTS: LOUISVILLE, KENTUCKY MOLINE, ILLINOIS

AMERICAN **HV-2** FILTER

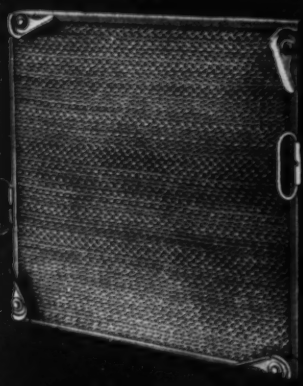
Here is an example of AAF engineering for economy in installation.

This filter is furnished in three designs to meet various application requirements. Two of these designs are for use as frame units and one without handles or latches where supporting members are provided.

The frames are easily assembled with standard #7 rivets and may be installed in straight bank or V-arrangement.

This same careful attention to easy installation has been applied to AAF's entire line of air filters, from electronic precipitators to the inexpensive AMER-*glas* disposable filter.

When you compare prices, don't overlook the cost of installation.



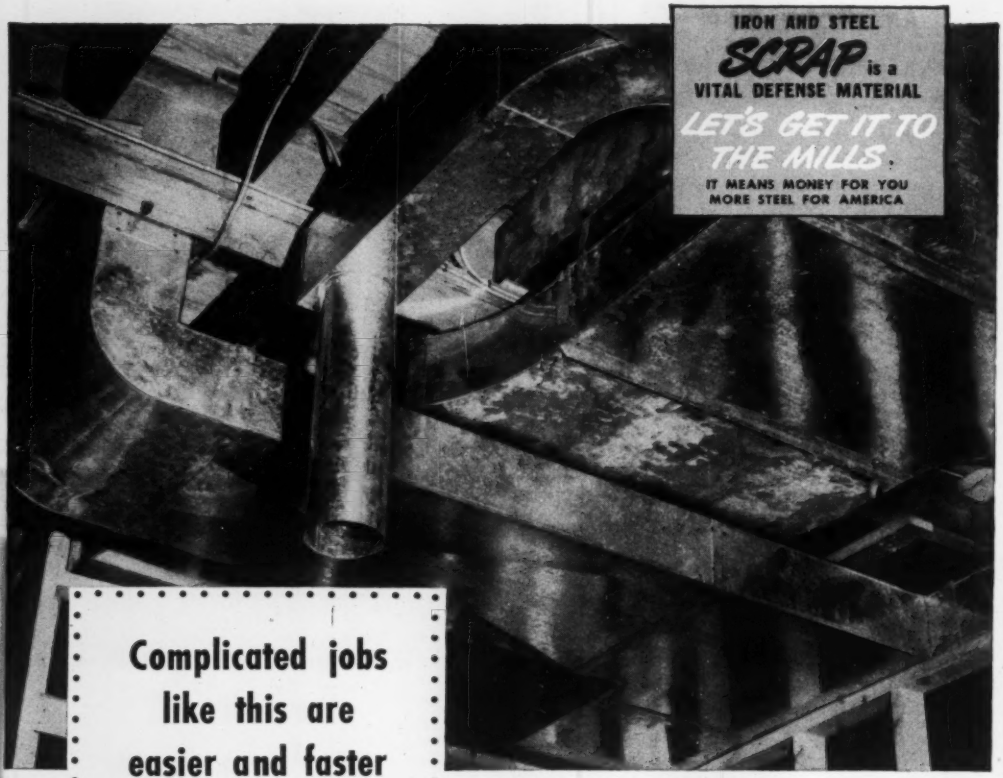
AMERICAN Type HV-2
Air Filter

HERMAN NELSON
DRAFT | STOP SYSTEM

DRAFT | STOP is a system entirely different from conventional classroom ventilation methods. Because it keeps classrooms free of drafts by trapping them near the source, it might be assumed that the DRAFT | STOP System presents a complicated installation problem. Since it does so well what other ventilation systems have always tried to do, you might expect installation to involve difficult engineering problems. Not so! No additional piping, traps or valves are required with DRAFT | STOP. The DRAFT | STOP System can be installed simply by (1) Standard piping of the proper size Herman Nelson Unit Ventilator; (2) Arrangement of a suitable combination of utility cabinets; (3) Locating and installing in the wall, when required, the Ventimatic exhaust outlets.

Your DRAFT | STOP System can be a wall-to-wall installation, but it need not be. Flexibility is another benefit of Herman Nelson designs. It makes for rapid installation with fewer piping problems, another benefit when DRAFT | STOP is specified.

MATCHING CABINETS



Complicated jobs like this are easier and faster when you use

This extensive ductwork job, with its numerous joints and bends, is typical of the kind of work you can do with U·S·S Galvanized Steel Sheets.

U·S·S GALVANIZED STEEL SHEETS

THE many fine fabricating qualities of U·S·S Galvanized Steel Sheets really pay off when you're handling bends and joints in intricate ductwork layouts. For you can bend, roll, cut or stamp these sheets in minimum time with the best results.

And the fine performance of U·S·S Galvanized Steel Sheets in the shop is equalled by the way they stand up in service. The heavy, uniform protective coating of zinc is bonded tightly to the steel surface.

When you can combine U·S·S Galvanized Steel Sheets with quality workmanship, it's no trouble at all to produce the efficient, long-lasting kind of ductwork jobs that mean complete customer satisfaction and more jobs for you.

COLUMBIA STEEL COMPANY, SAN FRANCISCO · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL COMPANY, PITTSBURGH
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **GALVANIZED STEEL SHEETS**

1-581

UNITED STATES STEEL

BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better

There are just two steps to closing more business

THE FIRST STEP IS—*use this coupon*

Just fill it in and mail it

We will know this is your request for a Brunner factory representative to stop in and go over the reasons why Brunner dealers find it easier to close business.

Name

Company

Address

City and State

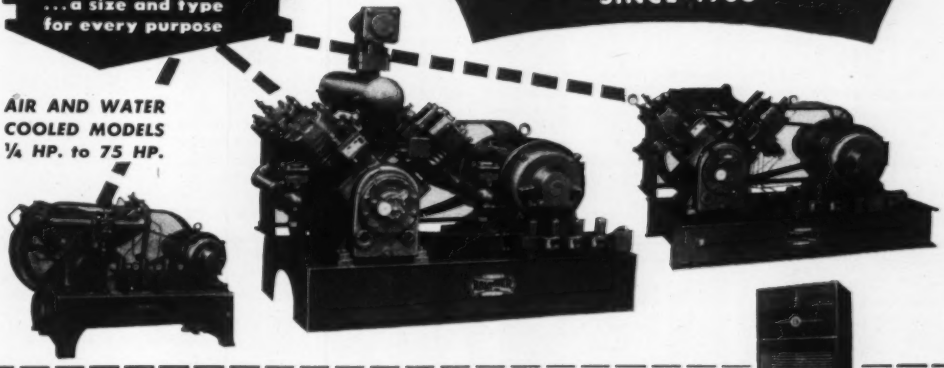
With all the facts fresh in mind you will recognize the second step—recommend and install Brunner's from now on. With 69 models comprising a complete range of commercial capacities and types, a dependable source of supply and a known product with ready acceptance by your customers, selling obstacles are removed and you are on the way to bigger business. We will be looking for the coupon.

BRUNNER MANUFACTURING COMPANY
Utica 1, New York, U. S. A.

REFRIGERATION CONDENSING UNITS ...a size and type for every purpose

BRUNNER SINCE 1906

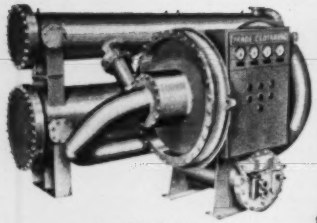
AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.



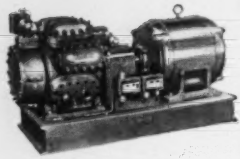
BRUNNER SINCE 1906

AIR CONDITIONING

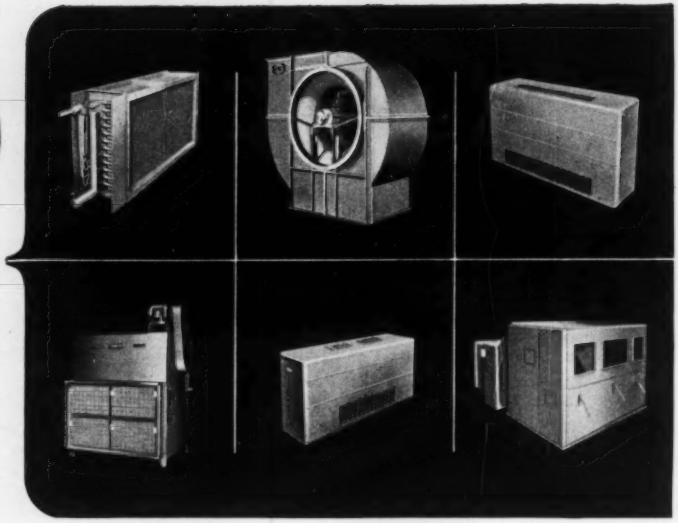
Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.



Trane CenTraVac



Trane Reciprocating Compressor



Trane Cooling Coil (above) Trane Climate Changer

Trane Centrifugal Fan (above) Trane Custom Air Unit

UniTrane Air Conditioner (above) Trane Multi-Zone Climate Changer

How matched Trane Products make better systems

Here's why more and more people are specifying, installing and using more and more Trane matched products each year.

Specifiers know that Trane manufactures everything from hot water valves to refrigeration units. Using Trane equipment, they can create a wide variety of complete systems for every type of building. They combine Trane Evaporative Condensers with Trane Reciprocating Compressors, Trane Fans with Trane Cooling or Heating Coils, Trane Unit Ventilators with Trane Steam Specialties.

And when they use Trane equipment together, they are not only getting the fine features that have established individual Trane products as leaders in their respective fields but a lot more as well.

Save Time—If they need equipment counsel they see one salesman-engineer instead of several. They use one set of completely integrated catalogs conveniently bound into one handy binder.

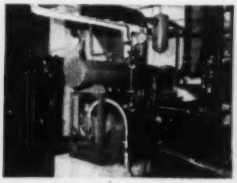
Save Trouble—When they use Trane equipment to create a system, Trane assumes the responsibility for the correct performance of all its equipment when properly installed and controlled. There is no blaming the product of one manufacturer because the product of another doesn't operate satisfactorily.

Better Performance, Too—Trane products are designed together, made together, tested together for service together. Each product is built to the same high level of quality. Into each product, Trane has incorporated important construction features that make that product a leader in its field. When these leading products are used together in a system, better performance is inevitable.

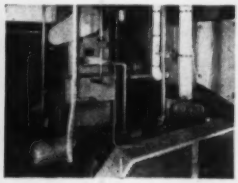
Add to all these specific advantages those that the installer enjoys. He orders equipment directly from one supplier. He can plan shipment of equipment more easily. He writes one check for the whole system. Bookkeeping is cut to the bone. So is installation because Trane products fit better together.

When Trane products are used together in complete systems the user gets a better installation. Join those who have already found the advantages of complete Trane systems—specify and install Trane products.

Equipment room of a large office building where Trane centrifugal refrigerating units supply chilled water in an extensive Trane air conditioning system.



This Trane Condensing Unit is perfectly matched with Trane Direct Expansion Coils to form the heart of a Trane system for the coffee shop of a large hotel.



Real Trane product teamwork is illustrated by this complete Trane Compressor, Trane Evaporative Condenser and Trane Climate Changer installation.

TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pennsylvania
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OFFICES IN 80 U.S. and 10 CANADIAN CITIES

WeldELLS®

Whatever you seek on that next welded piping job...*speed*...*economy*...piping for *extreme conditions*...piping to withstand *corrosion*...you will find the answer to it in piping welded the WeldELL way.

You will find the answer because the WeldELL line incorporates job-speeding, cost-cutting features that are combined in no other welding fitting.

You will find the answer because the WeldELL line expresses the best of all we have learned in fifty years of intensive specialization in forged fittings for designed piping and pressure vessels.

The WeldELL line also goes beyond all others in range of sizes, types, thicknesses and scope of materials. Form a good habit—the WeldELL habit. Your reward will be the deep-down satisfaction of using the best there is! Coupon brings catalog.

Taylor Spiral Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.

TF

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Offices in all principal cities.
Eastern Plant: Carnegie, Pa. • *Western Plant:* Fontana, Calif.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.
☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

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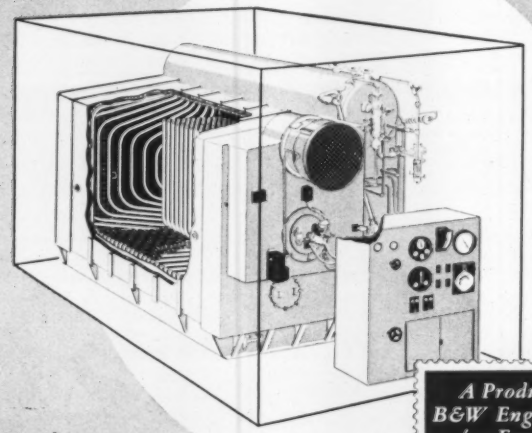
NOW

Big boiler advantages "wrapped up" in NEW COST-SAVING B&W SHOP ASSEMBLED UNITS

B&W Integral-Furnace Boiler, TYPE FM



A Product of B&W Engineering for Economy

Cost-Saving Features of the New B&W Integral-Furnace Boiler, TYPE FM

- Saves Erection Time and Cost
- Meets Wide Range of Services
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

Here at last is the ideal combination for efficient, low-cost "packaged" steam: the new B&W Integral-Furnace Boiler, Type FM. It combines the many advantages of factory-assembled boilers with the service-proved economies of B&W Integral-Furnace construction. It's delivered fully-equipped for immediate operation.

Of prime importance is the fact that this new B&W boiler embodies design, construction, and operating features that have made larger capacity Integral-Furnace units such a heavy favorite among industrial plants and central stations.

Small and medium size plants, institutions, and commercial establishments will find this new unit the ultimate in low-cost heating and process steam-generation from 3,500 to 25,000 lb. per hr. at pressures to 250 psi. Large plants, too, where space and load characteristics warrant, may profitably consider several packaged boilers instead of a single "tailor-made" installation.

Engineered, designed and built under a single responsibility, the new Integral-Furnace Boiler, Type FM is backed by the same tradition of service satisfaction that has made B&W a by-word in low-cost steam generation for more than 80 years.

Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

Send for Bulletin G-72, detailing the many advantages of this new B&W creation in low-cost steam generation.
The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

G-506

THE EDITOR'S PAGES

• IN A BOOK REVIEW by Christopher Tunnard published in Architectural Record, we found a word we'd never heard before — a word which most usefully describes our desk's usual condition (as well as the living-room at home). The word is "sharawaggi", and it implies — says Mr. Tunnard — an "esthetic of careless or disorderly grace." It refers to the Chinese "want of symmetry" in gardens, grounds and buildings. . . . There are many factors which, if properly planned and executed, add materially to the enjoyment and "efficiency" of the audience at an engineering or technical session. The details of presenting a paper are particularly important when the subject is complicated and includes charts, equations and tables which the audience must follow. One detail that seems to help — and which was used by G. Gill Freyder, of the Commonwealth Edison Co., Chicago, when he presented a paper at the recent Midwest Power Conference — is the "white line on dark background" lantern slide, rather than the more usual slide which shows a black line on a white background on the screen. With the reverse or white line slide, there is much less glare from the screen, and the audience can watch a series of slides with greater comfort.

RECORD DEMAND FOR OIL HEAT

DESPITE "RECORD-BREAKING public demand" for oil heating equipment, industry leaders estimated last month at the Oil-Heat Institute of America convention in Chicago that government restrictions would cut 1951 oil burning equipment production at least 20 percent below the 1950 level of 925,000 units. The estimate was presented by A. T. Atwill, OHI's president, at the opening of the week-long oil heat exposition at Navy pier.

Mr. Atwill said the institute estimated that, given unrestricted access to materials, the industry could produce and sell well over 1,000,000 such units in 1951 to make it the biggest year in oil heating history.

"The 1,000,000 figure," he said, "is based on a continuation of the great public demand for oil heat during the first quarter of this year. We estimate that 105,900 oil heating installations were made in the first quarter of 1951 as compared with 84,300 in the same 1950 period."

Reviewing industry figures, Mr. Atwill pointed out that as of the end of 1950, there were 12,200,000 residential oil burners in use in the United States and at least 1,000,000 commercial and industrial oil burners in operation. "These figures indicate more than one-third of all Americans enjoy the benefits of oil heating in some way", he said.

"PERFORMANCE FACTOR" REPLACES "COP"

"PERFORMANCE FACTOR" is the newer and preferable term to be used in place of "coefficient of performance" in discussing the performance of a reversed refrigeration cycle (the heat pump) over an extended period of time, it was pointed out at a heat pump session at the recent Midwest Power Conference.

CLASSROOMS OBSOLETE WITHOUT GOOD HEATING

PHYSICAL FACTORS in 95 percent of the nation's classrooms hinder rather than help the child's development, learning and physical wellbeing, Dr. Darell Boyd Harmon, consulting educationalist, recently told a group of Pennsylvania educators.

Dr. Harmon, former director of the division of school health services for the Texas state department of health, and consultant for the school division of Minneapolis-Honeywell Regulator Co., was a featured speaker at a recent institute on classroom planning sponsored by the University of Pennsylvania.

"We must recognize that there are, in effect, two teachers in every classroom." Dr. Harmon said. "One is the human teacher who plans the child's educational experience. Present also are a combination of environmental forces, lighting, heating, sound, decoration and seating that are equally important to the child's development and learning.

"Improper heating, for example, can distort the whole child," he pointed out. "It affects his bones, his muscles, his body structure and his learning as he makes adjustments to feel comfortable."

Dr. Harmon believes that a schoolroom should be "coordinated" so that the physical factors provide a surrounding that meets the needs of the child. Two recent independent studies of what the modern school should be like indicate a heartening awareness of the need for proper planning, he said. For instance, the Citizens Federal Committee on Education and the Public Education Association recommend the installation of temperature controls to regulate indoor temperatures according to varying conditions. Both studies also emphasize the importance of such other environmental conditions as lighting, color, classroom design, soundproofing and window treatment.

"QUOTE"

"TO MY CUSTOMERS —

"Due to my independent position as a sales engineer, I have decided to show my lines at times best suited to my convenience.

"At the moment, it pleases me to show my products only on Tuesdays and Thursdays from 2:00 to 4:00 p.m. I must have my weekends, and play golf. My recreation should not be neglected.

"The above regulations apply only so long as the international situation and defense efforts produce a scarcity of materials. After that, I will be around to call on you as usual.

"Signed .....
SALES ENGINEER"

HUMIDIFYING COMBUSTION AIR LEADS TO AWARDS

EACH YEAR SINCE 1946 a committee appointed by the president of The Detroit Edison Co. makes up to five awards to employees who have shown signal initiative and skill beyond the call of duty. Named in honor of

Detroit Edison's first president, the late Alex Dow, the award entitles each winner to a certificate, engraved watch, lapel pin and five shares of Edison stock.

The awards this year to Metallurgist Glenn Coley, of sales, and Paul Murphy, boiler room engineer at the Delray power plant, were based upon their development of a method to humidify the combustion air used in stoker fired boilers at power plants. Slag has the habit of collecting in the many tubes of a stoker fired boiler, reducing efficiency. It had been a serious problem for years.

Because of Mr. Coley's previous experience in the blast furnace industry, he knew of a definite relationship between humidity of air and the formation of boiler slag. As a result of this knowledge, he communicated with people in the production department. He called attention to the possible effect of humidifying the air which might reduce this troublesome slagging.

When Mr. Murphy became boiler room engineer at Delray, he became interested in the subject. They worked out a program for proceeding with an experimental installation. This had the approval and complete cooperation of Superintendent Chester Schmansky. The work was carried forward with vigor and the assistance of others. It proved successful in reducing slag and, with it, boiler maintenance. All boilers at Delray are now equipped with humidification devices and the idea is being adopted on boilers at the Conners Creek plant.

PREDICTS ATOMIC POWER USE IN 10 YEARS

WAR OR NO WAR, America may be using atomic power within 10 years, said Burgess H. Jennings, chairman of the mechanical engineering department at Northwestern University's technological institute, in a recent address before the Northwestern chapter of Sigma Xi, honorary research society.

"If we think of 1 lb of fissionable material as being the equivalent of 2,500,000 lb of coal, then the price of uranium can be high and still be competitive with other fuels," Dr. Jennings explained.

He said atomic energy will never replace our other fuels and even under the most promising conditions will probably not produce more than 5 percent of the power which the world requires.

Regarding the use of atomic energy for power, Dr. Jennings said research has made two things clear: (1) that it is possible to use fissionable material as an energy source, and (2) that it is apparently impossible to use this material to produce electrical energy directly from atomic disintegration.

"This means," he said, "that in order to produce electrical energy from this source it is necessary first to transfer heat from the atomic reaction into some working medium which directly can expand in a prime mover or to use the atomic energy to warm a heat transfer medium which, in turn, can generate steam for driving a power plant."

CLAY PIPE DUCTS DISTRIBUTE WARM AIR

A NUMBER OF unusual features are incorporated in a recently-completed building that houses the garage, showroom and office facilities of the Spot Motor Co., an automobile dealer in Akron, Ohio. A total of 25,000 sq ft of floor space is included in the new structure, designed by Beiswenger and Hoch, architects, and built by Forbs-Stanford Co.

The heating system is of particular interest. Distribution of heat is through vitrified clay pipe underfloor ducts. The system required a total of 250 ft of extra-strength clay pipe and fittings. The main duct system starts with 24 in. pipe at the furnaces, reducing to 12 in. at the farthest perimeter points in order to equalize heat output.

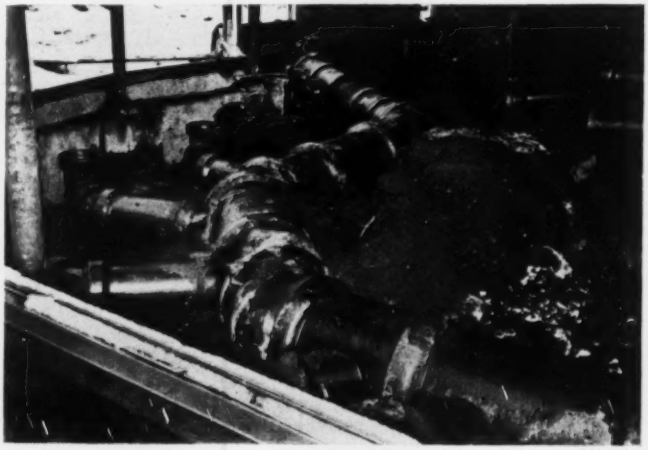
From the main ducts, branches of 8 in. clay pipe connect with 17 registers in the floor at the base of the showroom windows. Louver controls on the registers permit adjustment of heat output and make it possible to direct heat flow against the windows to defrost them in winter. Heat is supplied by two forced air, gas fired blower units, with a combined output of 250,000 Btu per hr.

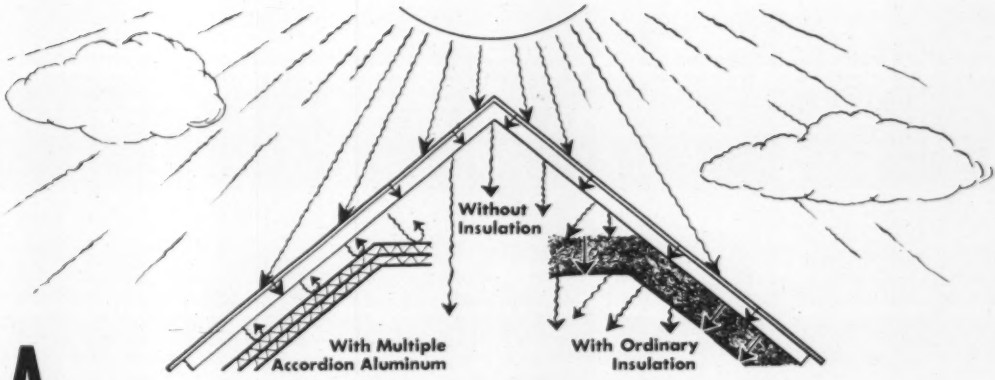
Trench depths for the heating system vary from 42 to 24 in. The vitrified clay pipe was cradled in sand and backfill tamped to a height of 6 in. over the top of the pipe. All joints were made with hemp packing and mortar. Wire mesh reinforcing was laid over the backfill and floor masonry poured to a depth of 6 in.

Another feature of the new building is the system used to dispose of monoxide fumes in the service garage. Vitrified clay pipe monoxide vents connect with lifts, pits and repair stations, accommodating approximately 40 cars, and carry off exhaust fumes through outlets in the roof. The system required more than 300 ft of 4 to 10 in. clay pipe and fittings.

Vitrified clay pipe was specified because of its non-corrosive qualities, ease of handling and resistance to "buckling" as concrete floor slabs are poured. [Photo courtsey Robinson Clay Product Co.]

HEAT DISTRIBUTION is through vitrified clay pipe underfloor ducts, starting at 24 in. diameter and reducing to 12 in. Branches 8 in. in diameter connect to registers under the show windows





An Empty Roof Space Would Be The Best Insulation Against Summer Sun, *Were It Not For Radiation*

Convection is not a problem — there is no Convection downward. The only heat flow in summer through an empty roof space is Radiation, except for insignificant Conduction. Heat flow by conduction through roof spaces — through any building air space — is about 5%.

Ordinary insulation may retard heat for two or three hours, but builds up a large heat storage as compared to empty space. Fairly solid, it is a much better conductor of heat than empty air. Its surfaces absorb more than 90% heat rays. The heat passes through it by conduction, and is then radiated into the rooms at a 90% rate all through the day and into the night.

The solution is to use a material which has little substance and whose surfaces will not absorb nor emit appreciable radiation. Silver foil would be excellent but tough multiple accordion aluminum, which weighs but 1/5 oz. a sq. ft., is inexpensive and has practically the same heat-ray absorption and emissivity (2% more). It absorbs only 3% of the preponderant radiant heat flow through building air spaces inside walls, ceilings and roofs, and emits but 3%. It is non-condensation forming, impervious to vapor, and its multiple air spaces practically eliminate conduction. The commercial form is Infra Type 4 and 6.

The National Bureau of Standards Booklet BMS52, "Effect of Ceiling Insulation upon Summer Comfort," lists on page 10, the "insulations tested" in the order of decreasing effectiveness in protecting the ceiling against summer heat, as follows:

"1) Two layers aluminum foil (both sides of each layer reflecting).

"2) Full thick (3⅝") rockwool."

Try this test: Tack or scotch-tape 3 sq. ft. of multiple accordion aluminum (we will send it free on request) to the underside of a hot roof or ceiling, whether uninsulated, or insulated with ordinary insulation. Step in and out of the protected area beneath. The difference will be so marked, you will need no thermometer.

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Down-Heat C.044 R22.72 equals 7½" DRY Rockwool
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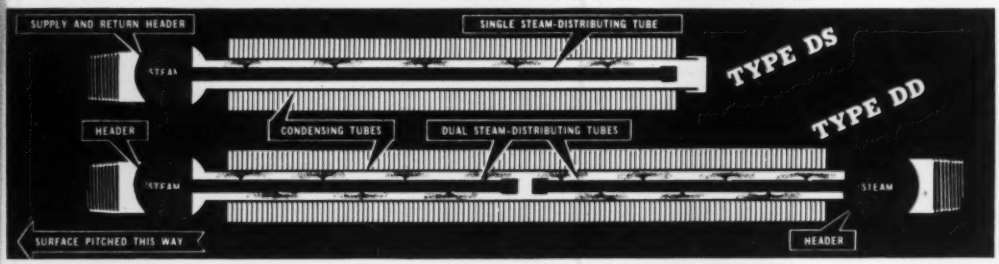
results from (1) Uniform Steam Distribution, and (2) Condensate always exposed to entering Steam

NESBITT SERIES D SURFACE IS MADE IN TWO TYPES:



TYPE DS SURFACE: Single supply header; single steam-distributing tube inside each condensing tube, for normal heating and ventilating applications. For installations requiring more uniform discharge temperatures, Type DS Surface with DUAL steam-distributing tubes in finned lengths up to six feet.

TYPE DD SURFACE: Two supply headers (one at each end of the surface section); DUAL steam-distributing tubes inside each condensing tube; steam conducted from the header at each end toward center. Assures uniform discharge temperatures over finned lengths from 78" to ten feet.

How STIFF are the surface requirements in that low-pressure, valve-controlled job of yours? Must you have *strictly uniform discharge temperatures*, regardless of coil length? Then specify Nesbitt Series D Heating Surface with DUAL steam-distribution tubes. Or do you have *less exacting requirements*, but still need acceptable distribution, regardless of coil length? Then specify Nesbitt Series D Heating Surface with SINGLE steam-distributing tubes. All Nesbitt Series D heating coils are *freeze-proof* without the aid of pre-heaters because of the steam-distributing tube feature, developed by Nesbitt. Play safe: say *Nesbitt*.

FREE: Publication 247, Nesbitt Series D Heating Surface; Publication 248, Nesbitt Series H Surface, for Heating, Ventilating, Drying; Publication 246, Nesbitt Series W (Water) Surface, for Air Cooling, Dehumidifying, Heating.

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• DO YOU HAVE something you'd like to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to express your views on some other matter of interest to plant engineers, building engineers, heating, piping and air conditioning engineers or contractors? We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are most welcome to participate. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

WHAT IS A DRAFT?

IT WAS NOTED in a recent advertisement in HPAC that a draft was defined as air motion at 3½ fps, or 210 fpm.

This will be news to some of the authorities on the subject, inasmuch as this is about four times (in my experience) the actual figure, considering that a draft is a sensation involving both velocity and temperature.

It would be interesting, I think, to have a little discussion in these pages on "What is a Draft?"—J. H. C. (design engineer).

WHY ENGINEERS SHOULD WRITE ARTICLES

A FEW DAYS AGO, in discussing the matter of engineers writing technical papers for publication, I was asked whether I thought it was worthwhile for the engineer to do this. I can't set the problem up in a mathematical equation and give conclusive proof one way or the other, but I have been quite active as a contributor to various magazines and I wouldn't have done this if I hadn't thought it was well worth the effort.

Writing technical articles for publication is, for most of us, difficult and time-consuming work. All facts and calculations must be very carefully checked and double checked to avoid the embarrassment of having errors pointed out in succeeding issues of the magazine. The fees paid are modest — in many cases, nonexistent — so why should any engineer want to go to all of this trouble and give others the benefit of his experience instead of letting them find out for themselves?

Opposed to this viewpoint are some very good reasons — even selfish reasons — for writing technical articles.

To write a good technical article — one that is well thought out, logical and understandable — the author must conscientiously organize his material (even on the most familiar subject) in a way that he has probably never done before. If he is successful, his paper will be highly instructive and the one who will learn the most is the author himself. By putting his thoughts on paper, he will have increased his own knowledge of the subject and will be a better engineer for his efforts.

There is considerable personal satisfaction in being told by a stranger "I was interested in reading one of your articles several weeks ago." It is even more satisfying to find that someone has clipped one of your articles for his scrap book or to find that you are being quoted by other authors. Such experiences go beyond being just flattering, as they increase our professional pride, give us added confidence and spur us on to continued and better work.

An expert or an authority is one who possesses superior knowledge or superior skill. To become known as an authority takes publicity. An individual may do some outstanding work or achieve some very unusual accomplishment and may become famous overnight. But most of us will labor absolutely unknown, even though we may be doing very meritorious work, unless we do something about it. We cannot display an ad in the morning's paper stating that we are an authority, but if a business or technical journal prints something that we have written, and prominently displays our name and business connections, that will give us lots of favorable publicity if the article is a good one.

Advertising managers know that, to be effective, publicity must be a sustained effort. Just so will the engineer who is a frequent contributor to technical journals become well known, and he may gain recognition as an authority. The results should be equally happy for the employer. Both the individual's and the company's reputation will be enhanced. The engineer will probably be of greater value to his company, and it is to be presumed that he will be rewarded accordingly.

Fees paid for technical articles are of minor importance. The professional author must of course be paid for his work so that he may live, but this is not the case with the engineer whose writing is incidental. His reward will be great whether the publisher pays him anything or not.

The young engineer may wonder when he should start, and the answer would be as soon as he has something to write about — as soon as he knows something well enough that he can write an informative paper. It is not necessary to wait until he has some startling new development to report upon. If he were drawing up a patent application, he would swear that his subject is new, but magazine articles do not have to have brand new subject matter in order to be interesting and instructive. The description of some plant is a good subject, and so is a clear and understandable description of an old process.

A reprint of a lecture on the ABC's of refrigeration has been in demand for many years. It described the operation of a refrigerating system in the simplest terms. The paper finds wide use in training new employees. This particular paper has undoubtedly been read by many more people than other highly technical articles by the same author, and by that token it has probably been one

of the most useful articles that he ever wrote.

The sooner the young engineer tries his hand at writing, the quicker has he made a start on his own "advertising campaign."—LEON BUEHLER, JR., Creamery Package Mfg. Co.

SIZING RELIEF VALVES FOR HEATING BOILERS

REFERRING TO THE report on pages 124, 125 and 126 in the April HPAC on the safety conference at which the rules for sizing and installing pressure relief and safety valves on low pressure hot water heating boilers were explained, we have discussed this matter on several occasions. We are not in any disagreement about the problems that exist in meeting the requirements of the American Society of Mechanical Engineers Boiler Construction Code regarding these valves, but have disagreed on the method of best solving these problems.

The ASME code is not a static one. It is flexible because arrangements are made so that changes can be incorporated into the code continuously. Where the code is inadequate, the procedure in our opinion should be to ask for changes in the code rather than to promulgate rules and regulations which are then not covered by the code itself. This has been our point of contention.

We think that this paper was very well done. Yet we feel that it would be better to have the problems broached in the paper brought before the ASME boiler code committee and an attempt made to solve them. —H. A. LOCKHART, Chief Engineer, Bell & Gossett Co.

MAINTENANCE EXPENDITURES RELATED TO KWHR

THE QUOTATION from my paper given at the plant maintenance conference in Cleveland, and published on page 91 of the March HPAC, is correct as far as it goes. However, this quotation states only that a consistent policy of accounting is necessary in order to be able to work out consistent budgets.

The actual method of *making* the budgets is based upon the relation between maintenance expenditures and the activity of the plant as measured by power consumed. The paper shows that, in our own plants, production and maintenance are both related to the kilowatt-hours of electric power consumed. Therefore, for any projected rate of production, we can estimate from our curves the probable kwhr consumption and can then predict maintenance cost by means of a formula which takes account of man-hours of labor, rates of pay with overhead, and maintenance material.—D. E. PIERCE, Chief Engineer, General Aniline & Film Corp.

MAYO ARTICLE OUTSTANDING

I THINK William Sturm did a wonderful job of writing his article on the air conditioning of the new Diagnostic building at the Mayo Clinic, which was published in the April HPAC. Both he and the others concerned with the design of this system should be complimented.

We have done numerous hospital buildings, and hope some day we will have a client who will let us do an installation as thoroughly as they are doing at Mayo.—GERALD C. DITTMAN, Schmidt Garden & Erikson, Architects-Engineers.

OXYGEN PIPING FOR HOSPITALS

IN THE ARTICLE on oxygen piping systems for hospitals, in the March HPAC, the statement is made that the oxygen station outlets "can be exposed on the walls or enclosed in a metal box with a hinged cover." There is also available a flush service outlet that is similar to an electric receptacle. There is a 2 in. plate on the wall, and the flow meter is inserted in this receptacle.

In the same paragraph, mention is made that two outlet valves can be installed on the same single drop in order to administer oxygen to patients in adjacent beds. Because of the fact that this is quite a rare occurrence, nearly all systems now being specified call for a single outlet between two beds, and most of the manufacturing companies furnish a portable double outlet connection which can be connected to a single outlet and serve two patients. In a hospital with, say, 100 beds, this would represent a substantial saving in the installation cost merely because of the 100 extra valves involved and, of those 100 beds, there probably wouldn't be over six or eight at one time that would ever be supplying two patients; thus six or eight double outlets would be all that would be required.

Regarding section shutoff valves, mention should be made that packless diaphragm type valves should be used. I believe an association concerned with insurance is preparing a report calling for oxygen section shutoff valves to be bronze bodied, packless, diaphragm type, double seating valves. This is the type that seats in an open position so that even if a diaphragm must be replaced, it can be replaced with the valve either open or closed and without shutting down the service.

As to labelling of the section shutoff valves, all such valves should be labelled and a much more desirable instruction than that given in the article is "Oxygen section shutoff valves" and then underneath it to state "Valve to be ON at all times except in emergency". I have seen hospitals with every section shutoff valve in the place labelled "Oxygen for surgery," and this is not regarded as the right way to do it.—ALBERT E. MCKEE, President, Oxygen Equipment & Service Co.

MAKE ARTICLES EASIER TO READ QUICKLY

TECHNICAL AND trade magazines are the most important sources of information for engineers — careful reading and digesting of information given in their pages is a "must" for the professional engineer.

However, the task is a formidable one and I'd like to suggest better organization of technical articles for more rapid reading. For example, I'd like a headline that gave the theme of the article completely. I'd like a first paragraph that told the gist of the article and then the following paragraphs could give the pertinent details. Newspaper copy is written in this way and it could well be adopted by writers for technical journals.

Just one other criticism, in regard to the tone of some of the comments on published articles. Can't you clean them up so they read less like the snarling of the Kilkenny cats?—HARRY TERRY, Consulting Engineer.

DEFINITION

IMPRESSIONISTIC AIR CONDITIONING — Hit the supermarket customer with cool air at the entrance and at the checkout counter.

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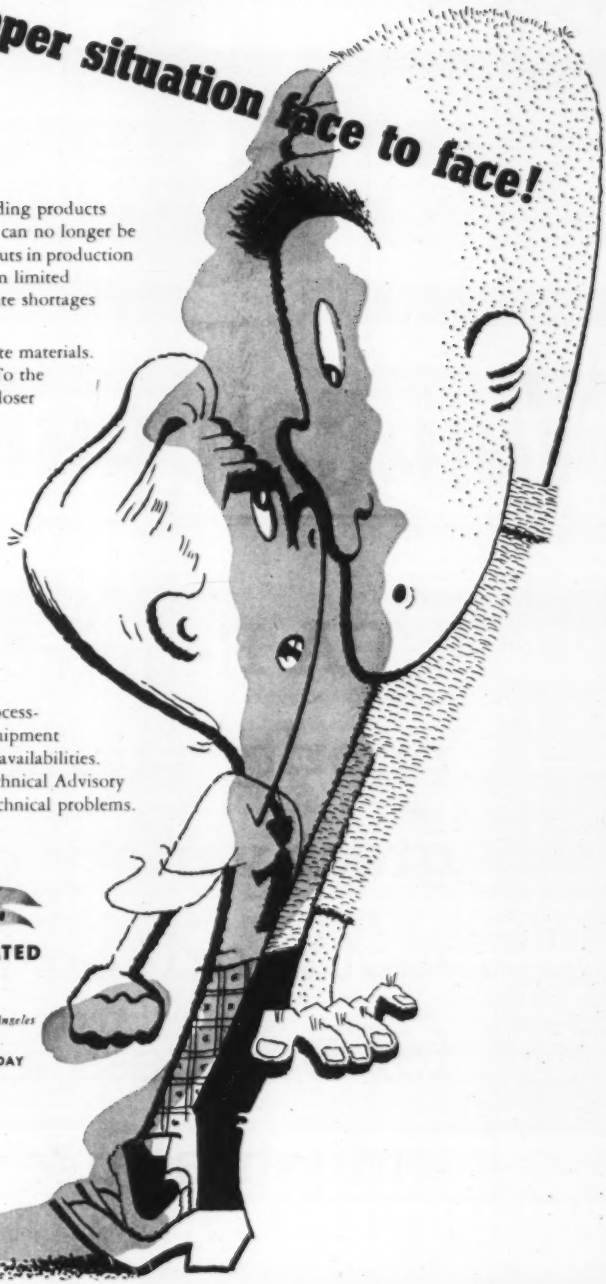

• In the months ahead there will be some building products formerly made of copper and copper alloys that can no longer be made of these materials. Others, due to required cuts in production and D.O. rated orders getting first call, will be in limited supply. Further complications arise from the acute shortages of raw materials.

In some cases you will be forced to use substitute materials. But that doesn't mean we must part company. To the contrary, the present situation should bring us closer together. Because you're going to have more problems than ever, we may be able to help you through Revere's Technical Advisory Service.

This Service is backed by a wealth of knowledge accumulated over a century and a half of working with metals. Why not put that knowledge to work for you? Revere would like to collaborate with you regarding the usage, to their best advantage, of the products you *can* get.

And don't forget, while supplies are limited, you can still use Revere Copper Water Tube in domestic hot and cold water lines, industrial processing lines, underground service lines, and gas equipment piping. Check with your Revere Distributor for availabilities. He will also put you in touch with Revere's Technical Advisory Service in the event you wish to discuss your technical problems.

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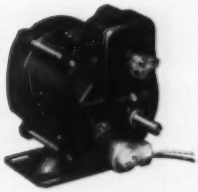
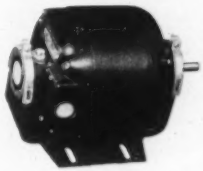


Gas Pump

General Purpose



Belted Fan

G-E Motors—*FAST!*

IF YOU have a D. O. rating or if you manufacture products used as maintenance, repair or operating supplies for business or industrial purposes, you MAY now be entitled to a priority rating which will enable you to purchase the fractional horsepower motors you need. *And General Electric can fulfill your standard-motor requirements faster than you might think!*

Barring unforeseen emergencies or new rulings subsequent to the writing of this message, General Electric has the facilities to handle your priority needs with pre-Korea speed. What's more, General Electric application engineers stand ready to help you design or re-design your products so that standard motors can be used to *your* best advantage.

Write, wire or phone the nearest General Electric office or your nearest authorized distributor to start the ball rolling. *General Electric Company, Schenectady 5, N. Y.*

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These recent bulletins have been specially prepared to help you make better use of G-E motors and services. Send for them today.

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Please send me the following publications on G-E fractional-hp motors:

- ☐ GEA-3989—description of all G-E Factory Service Plans
- ☐ GEA-5566—detailed explanation of how to use the G-E Motor Exchange Plan
- ☐ GEA-5174—description of standard G-E fractional-hp motors
- ☐ Please have salesman call

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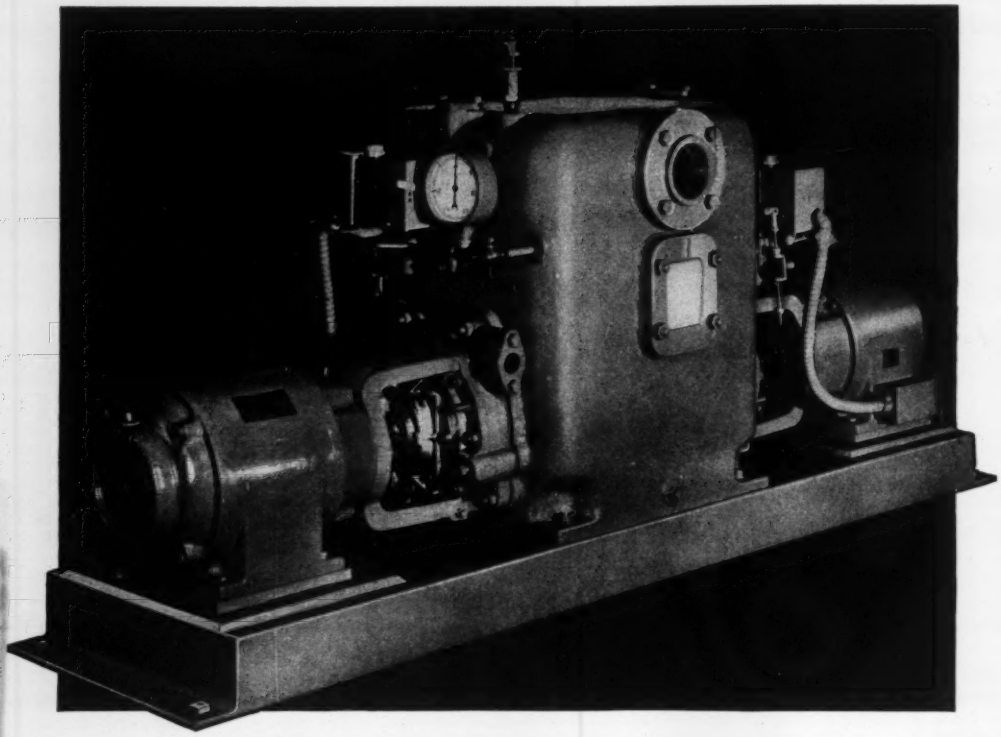

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A Jennings Return Line Vacuum Heating Pump may be installed with the absolute assurance that it is of the proper capacity to keep your heating system at top-notch efficiency.

For the actual working capacity of your Jennings Pump is determined by careful tests under working conditions, and with the actual motor that goes on your job, regardless of current characteristics. Every Jennings Pump has to deliver full rated capacity of air and water simultaneously before it is released.

The Jennings Heating Pump has everything in the way of safety, convenience, and real dollar saving economy that years of experience as leading heating pump manufacturers have enabled us to put into it. Quality is backed by an unchallenged reputation, and satisfactory performance is assured by a nation-wide network of Sales and Service offices.

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How to Use Schedule Numbers in Power Piping Design

Sabin Crocker Explains Relation of the Schedule Number System to Code Formulas for Determining the Wall Thickness of Power Piping

SOME 20 YEARS AGO, when the American Standards Association sectional committee B36 undertook the standardization of a series of pipe wall thicknesses, it started with a survey of existing weights of steel and wrought iron pipe. The commonly used wall thicknesses of that time, which were traditionally known as "standard weight", "extra strong" and "double extra strong", dated back to 1886 to the work of an American Society of Mechanical Engineers committee on standard pipe and pipe threads. Sectional committee B36 found that the wall thicknesses of different pipe sizes in any one of the old series were not suited to uniformly consistent service conditions. The old "standard weight" series was further confused through the presence of two thicknesses of 8 in. pipe, three of 10 in. pipe, and two of 12 in. pipe. Likewise, there had been intermediate sizes — 4-1/2, 7, 9 and 11 in. — that were infrequently used and could well be eliminated.

Under old usage, these deficiencies had not been too important because pressures and temperatures were relatively low so that a few series sufficed and wall thicknesses were governed more by manufacturing practice and the need for providing sufficient metal for mechanical strength and/or corrosion. With the then rapidly increasing trend to higher service pressures and temperatures, however, sectional committee B36 found, first, that more series of wall thickness were required; second, that these series should be based on some rational system related to service conditions; third, that the new series should enable a more direct application of the various safety code formulas for relating commercial wall thickness to service conditions; and, fourth, that little used intermediate sizes should be eliminated so as to concentrate production and stocking on sizes commonly ordered.

What Schedule Numbers Mean

Hence, in devising the schedule number system as the basis for a logically progressive series of pipe wall thicknesses, ASA sectional committee B36 originated the idea of basing the system on a dimensionless parameter or ratio equal to 1000 times the internal pressure divided by the corresponding bursting stress in the pipe wall, viz:

$$1000 \times \frac{P}{S} = 1000 \times \frac{\text{Internal Pressure}}{\text{Bursting Stress}} \quad \text{[1]}$$

The factor of 1000 was introduced by the committee for convenience in order to make the ratios derived from the expression come out as whole numbers. This results in having Schedule 40, Schedule 80, etc. instead of Schedule 0.040 and Schedule 0.080, which are more awkward to say.

Attention is called to the fact that the P/S values or $1000 \times P/S$ values are dimensionless ratios that apply to any system of measurement. This is apparent from writing the units of measurement into the equation and observing that the units cancel out, as shown by the following example using pounds pressure for force and square inches for area:

$$\left(1000 \times \frac{P\,lb}{sq\,in.}\right) \div \left(\frac{S\,lb}{sq\,in.}\right)$$

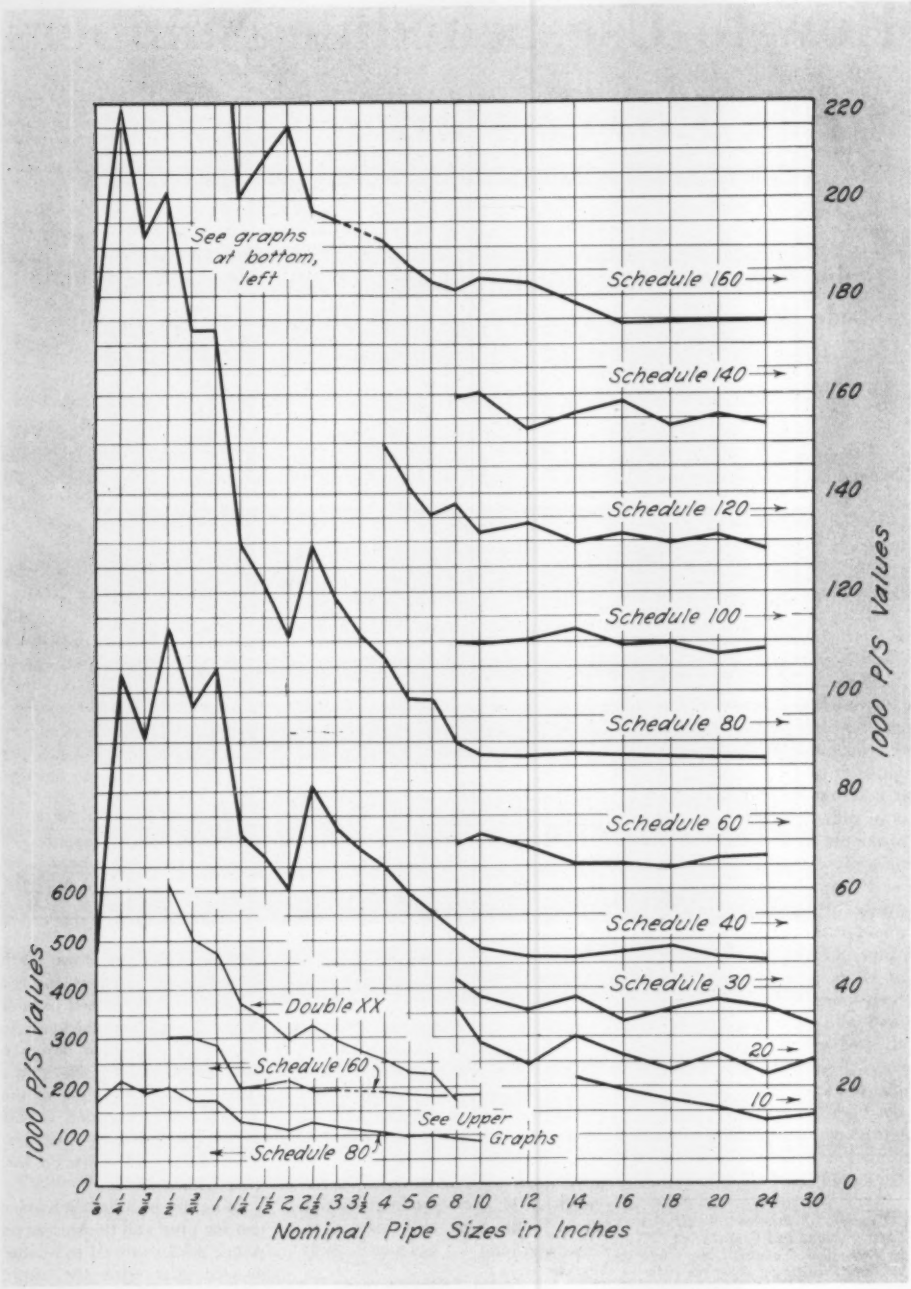
$$= 1000 \times \frac{P\,lb}{sq\,in.} \times \frac{sq\,in.}{S\,lb}$$

$$= 1000 \times \frac{P}{S} \quad \text{[2]}$$

More recently, the use of the dimensionless P/S index for comparing the results obtained by applying different pipe wall thickness formulas to a given set of design conditions has found considerable application. As an example of this use of P/S ratios, attention is called to ASME paper No. 50-A-62, by Buxton and Burrows, Formula for Pipe Wall Thickness.

In basing its schedule number system for pipe wall thicknesses on P/S ratios, ASA sectional committee B36 decided that with the variety of materials available for pipe use, the thickness schedules to be flexible could not be set with respect to any particular temperature, pressure or material. With schedules based on P/S values, where P represents the service pressure and S the corre-

Mr. Crocker, a member of HPAC's Board of Consulting and Contributing Editors, is Mechanical Engineer, Ebasco Services Inc., and Vice Chairman of the American Standards Association Sectional Committee B31 on Code for Pressure Piping. Mr. Crocker also was Secretary of the ASA Sectional Committee B36 on Standardization of Wrought Steel and Wrought Iron Pipe during the years it developed its schedule number system for pipe. He is thus in a position to write from first hand knowledge on the subject of this article.



1000 *P/S* VALUES vs. NOMINAL PIPE SIZES FOR PLAIN END STEEL PIPE. Computed from pipe wall thicknesses formula in the ASME Power Boiler Code and the power piping and district heating piping sections of the American Standard Code for Pressure Piping. As explained in the text, the plotted values include the code allowances for "mechanical strength and/or corrosion", and a 12-½ percent mill tolerance in pipe manufacture

WROUGHT STEEL AND WROUGHT IRON PIPE

Dimensions of Welded and Seamless Steel Pipe
(Listed by Schedule Numbers)

Nominal Pipe Size	Outside Diam	NOMINAL WALL THICKNESS									
		Sched 10	Sched 20	Sched 30	Sched 40	Sched 60	Sched 80	Sched 100	Sched 120	Sched 140	Sched 160
1/8	0.405	.....	.....	.....	**0.068**	.....	**0.095**	.....	.....	.....	.....
1/4	0.540	.....	.....	.....	**0.088**	.....	**0.119**	.....	.....	.....	.....
3/8	0.675	.....	.....	.....	**0.091**	.....	**0.126**	.....	.....	.....	.....
1/2	0.840	.....	.....	.....	**0.109**	.....	**0.147**	.....	.....	.....	0.187
3/4	1.050	.....	.....	.....	**0.113**	.....	**0.154**	.....	.....	.....	0.218
1	1.315	.....	.....	.....	**0.133**	.....	**0.179**	.....	.....	.....	0.250
1 1/4	1.660	.....	.....	.....	**0.140**	.....	**0.191**	.....	.....	.....	0.250
1 1/2	1.900	.....	.....	.....	**0.145**	.....	**0.200**	.....	.....	.....	0.281
2	2.375	.....	.....	.....	**0.154**	.....	**0.218**	.....	.....	.....	0.343
2 1/2	2.875	.....	.....	.....	**0.203**	.....	**0.276**	.....	.....	.....	0.375
3	3.500	.....	.....	.....	**0.216**	.....	**0.300**	.....	.....	.....	0.438
3 1/2	4.000	.....	.....	.....	**0.226**	.....	**0.318**	.....	.....	.....	.....
4	4.500	.....	.....	.....	**0.237**	.....	**0.337**	.....	0.438	.....	0.531
5	5.563	.....	.....	.....	**0.258**	.....	**0.375**	.....	0.500	.....	0.625
6	6.625	.....	.....	.....	**0.280**	.....	**0.432**	.....	0.562	.....	0.718
8	8.625	.....	0.250	0.277	**0.322**	0.406	**0.500**	0.593	0.718	0.812	0.906
10	10.750	.....	0.250	0.307	**0.365**	**0.500**	0.593	0.718	0.843	1.000	1.125
12	12.750	.....	0.250	0.330	0.406	0.562	0.687	0.843	1.000	1.125	1.312
14	14.000	0.250	0.312	0.375	0.438	0.593	0.750	0.937	1.093	1.250	1.406
16	16.000	0.250	0.312	0.375	0.500	0.656	0.843	1.031	1.218	1.438	1.593
18	18.000	0.250	0.312	0.438	0.562	0.750	0.937	1.156	1.375	1.562	1.781
20	20.000	0.250	0.375	0.500	0.593	0.812	1.031	1.281	1.500	1.750	1.968
24	24.000	0.250	0.375	0.562	0.687	0.968	1.218	1.531	1.812	2.062	2.343
30	30.000	0.312	0.500	0.625	.....	.....	.....	.....	.....	.....	.....

From ASA B36.10 -1950.

All dimensions are given in inches.

The decimal thicknesses listed for the respective pipe sizes represent their nominal or average wall dimensions. For tolerances on wall thicknesses, see appropriate material specifications.

Thicknesses shown in bold face type for Schedule 40 are identical with thicknesses shown in bold face type for *Standard Wall* pipe in Table 4 of ASA B36.10 -1950. Those in bold face type in Schedules 60 and 80 are identical with thicknesses in bold face type for *Extra Strong Wall* pipe in Table 4 of ASA B36.10 -1950.

Some of the larger, heavier wall sections are beyond the capabilities of seamless mill production and must be obtained from turned-and-bored billets or other sources.

sponding stress at the service temperature, however, all three variables are taken into account in the single ratio.

The following basic formula used by sectional committee B36 for computing its pipe wall thickness schedules was derived from the modified Barlow formula then used in the ASME boiler code:

$$\frac{P}{S} = \frac{1.75(t - 0.1)}{D} \qquad [3]$$

where P = maximum internal service pressure, lb per sq in. gage; S = allowable stress in material due to internal pressure, at the operating temperature, lb per sq in.; t = nominal wall thickness of pipe, in.; D = outside diameter, in.

In adjusting the Barlow formula to this purpose, 2 was changed to 1.75 to allow for the 12-½ percent mill tolerance in pipe manufacture, and the allowance C for corrosion, etc. was rounded out to 0.1 in. The formula was not applied to nominal sizes smaller than 1 in., these thicknesses being selected according to traditional usage from commercial lists.

Using the above formula as a basis, sectional committee B36 endeavored to evolve its principal pipe schedules around the then commonly used "standard weight" and "extra strong" pipe lists. In this way, much of the "standard weight" list was used for Schedule 40 and "extra strong" for Schedule 80. Double extra strong pipe could not be fitted into the schedule system inasmuch as it did not follow any regular P/S pattern, but it has been retained in the B36 standard because it is still manufactured by the pipe mills and fills certain needs (as illustrated later in this article).

As stated in the American Standard for Wrought Steel and Wrought Iron Pipe, ASA B36.10-1950, this formula is not intended to be used as a basis of design. It is contemplated that the user will compute the exact value of wall thickness suitable for the conditions for which the pipe is required, as described in detail in the ASME boiler code, the American Standard Code for Pressure Piping or similar safety regulations. From the schedules of nominal thicknesses given in B36.10, a thickness may then be selected to fulfill the conditions for which the pipe is desired. If pipe is ordered by its nominal weight or wall thickness, as is customary in trade practice, the manufacturing tolerance on wall thickness must be added to the minimum thickness computed by code formulas. The next heavier commercial thickness may then be selected from the standard thickness schedules of B36.10.

The following formula for pipe wall thickness appears in current editions of the ASME boiler code and the power section of the American Standard Code for Pressure Piping:

$$t_{min} = \frac{PD}{2S + 0.8P} + C \qquad [4]$$

where t_{min} is the minimum pipe wall thickness in inches after allowing for manufacturing tolerance, and C is an allowance, in the case of plain end pipe, for "mechanical strength and/or corrosion" of 0.065 in. for pipe sizes above 1 in.

In order to put the code formula on a basis comparable to that of the B36 formula, it is necessary only to substitute the numerical value of C and allow for the 12-½ percent manufacturing tolerance by putting $t_{min} = 0.875\ t$, where t is the nominal thickness.

$$0.875t = \frac{PD}{2S + 0.8P} + 0.065 \qquad [5]$$

Transposing and solving for P/S

$$\frac{P}{S} = \frac{1.75t - 0.130}{D - 0.7t + 0.052} \qquad [6]$$

This compares with Formula 3 previously mentioned as used by sectional committee B36 in computing its pipe thickness schedules.

Chart Aids Selection of Pipe Wall Thickness

The accompanying chart is offered as a means of assisting designers in the selection of the proper pipe wall thickness for any given service conditions in power piping using plain end steel pipe. In some cases, the 1000 P/S value determined for the given conditions can be accommodated for all sizes by a single pipe schedule of those available. As illustrated in the first example given later in this article, this fortunate situation can be identified at once from the chart as soon as the 1000 P/S value is determined.

In other attempts to select the proper pipe wall thicknesses for a given set of power plant service conditions, it sometimes develops that no single schedule number will satisfy code requirements in all pipe sizes. Under these conditions it becomes necessary to pick and choose from available schedules in order to make a series of selections that will be satisfactory for each of the respective sizes to be used.

While this could be done through repeated solutions of the pipe wall thickness formulas given in the ASME power boiler code and in the power piping and district heating sections of the American Standard Code for Pressure Piping, the process would involve considerable time and effort with the chance of making an error in the rather involved computations. It is simpler and more dependable, therefore, to read the answer from a chart such as the one accompanying this article. In this way the problem can be visualized as a whole so that inconsistencies become apparent. Furthermore, the chance of making an error is reduced in proportion to the ease of solution.

The graphs shown on the attached chart were plotted from Equation 6 for pipe sizes larger than 1 in., and using a similar formula with C = 0.050 for sizes 1 in., and smaller. As a result, the graphs can be used directly for determining allowable P/S ratios for plain end pipe of the thickness schedules shown without having to make further adjustments for manufacturing tolerance and C allowance. In other words, manufacturing tolerances and C allowances are already provided for in computing and plotting the graphs.

Examples Show Chart's Use

The following examples are given for the purpose of explaining how to use the graph.

Example 1 — Simple Case Where One Schedule Suffices

Problem: What pipe schedule should be used for a steam system being designed for 475 psig steam superheated to 700 F? Assume that grade B carbon steel pipe will be used conforming to ASTM specification A106 and having an allowable stress (S value) of 11,400 psi at 700 F.

Solution: 1000 P/S = (1000 × 475)/11,400 = 41.6.

Referring to the chart, it is evident that all sizes of Schedule 40 pipe are a safe margin above the 1000 P/S = 41.6 ordinate of the chart. Hence, if the pipe is to be used with plain ends, Schedule 40 will be acceptable throughout.

Example 2 — Complex Case Where More Than One Schedule Is Required

Problem: What pipe schedules should be used for a steam system being designed for 1500 psig and 1000 F? Assume that chromium-molybdenum alloy steel pipe having an allowable stress (S value) of 6250 psi at 1000 F will be used.

Solution: 1000 P/S = (1000 × 1500)/6250 = 240.

Referring to the condensed graphs in the lower left corner of the chart, it appears that all sizes of double extra strong pipe smaller than 4 in. are above the 240 ordinate and hence are adequate for this service. It is further evident that the 1 in. and smaller sizes of Schedule 160 pipe are adequate. Hence the decision should be to use 1 in. Schedule 160 pipe, and 1-¼ to 4 in. inclusive double extra strong pipe.

The 5 in. and 6 in. sizes of double extra strong are just short of meeting the required 1000 P/S value of 240, but are almost close enough to qualify under the code provision that when computing the allowable pressure for a pipe of a definite minimum wall thickness, the value obtained by the formula may be rounded out to the next higher unit of 10. For practical purposes, 5 in., and 6 in. double extra strong pipe should be acceptable for these conditions and permission could be sought from state or municipal authorities for their use, or discretion exercised where conformance with codes is not mandatory.

For pipe sizes 8 in. and larger, none of the standard thicknesses are adequate for these conditions and special thicknesses will have to be ordered to suit mill practice and choice of manufacturing method.

SEES RISE IN REPAIR EXPENDITURES

EXPENDITURES FOR REPAIR and improvement of buildings will probably break all records during the next year, unless the output of materials is cut back further than now seems likely, A. Naughton Lane, president of the Producers' Council, stated recently.

"Although official government statistics indicate that expenditures for repairs and improvements have been running about $8 billion annually in recent years, careful analysis of the production and utilization of building products suggests that the actual figure may have been substantially higher. This may be particularly true in the case of residential improvements which are estimated by the Department of Commerce at around $3 billion a year in the last few years," he said.

Dehumidification Saves Water-Soaked Books After Big Library Fire

Operation "Air Mop-up" a Success

OPERATION "AIR MOP-UP" — one of the strangest and most extensive dehumidification jobs on record — apparently has saved the bulk of the 500,000 volumes in the vast Michigan State library, Lansing, following the disastrous $5 million state office building fire in February. Cooling and dehumidifying equipment was rushed into the building after thousands of tons of water had cascaded down through the unburned portion of the structure during the more than 24 hr fight against the fire.

Thousands of books were badly soaked, some beyond redemption. Others, already damp, began to swell in the abnormally high humidity and were threatened with mold and mildew. When officials finally waded into the library several days after the fire started, they took relative humidity readings which were in excess of 82 per cent.

Alvin W. Kremer, Keeper of the Collections of the Library of Congress, Washington, D. C., who had hurried to Lansing by plane in order to help out, gave this advice to those in charge:

"Get this place dehumidified as soon as you can. There's no time to waste. If you wait too long, you'll lose everything."

The Garlock Sales Co., Lansing, was called upon to tackle the job. With a crew of men working up to 16 hr a day, they installed 16 refrigerating coils, four on each of the four levels of book stacks. Three reciprocating compressors were attached to the coils, and the equipment operated around the clock in pulling water out of the air by lowering and controlling the temperature.

A 15 ton cooling unit, which had been installed earlier in the state prison at nearby Jackson, was borrowed and installed in the reading room of the library.

Twelve portable 1/3 hp dehumidifying units, designed to keep home basements and storage spaces dry, were installed in the partially flooded traveling library in the basement of the building, where jungle-like humidity prevailed, and in an upstairs vault. The vault contained original historical documents and state records, including papers signed by George Washington and Andrew Jackson.

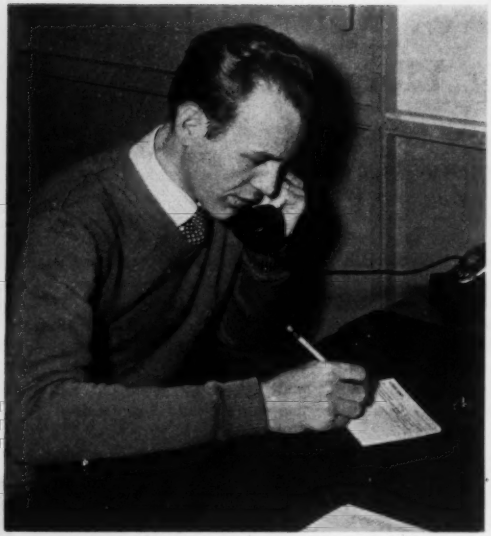
During the first week, nearly 500 gal of water was "squeezed" out of the air in the library. As the humidity was pulled down, the rate of extraction was slower but was still in the hundreds of gallons. About 1000 gal had been removed by the first of last month. Books which had swollen so tight in the shelves that they could not be moved gradually returned to normal size.

Mrs. Loleta Fyan, State Librarian, reported that it had not yet been possible to take a complete inventory, but that it appeared damage would be held to a minimum.

After two weeks of operation, the relative humidity in the library, which at one time hit 85, had been pulled down to 29 percent, while the temperature had been raised from 50 to 80 deg.

The dehumidifying operation was directed by Ron B. Garlock of the Garlock Sales Co. and M. L. Baldwin, veteran Garlock engineer. While reporting they had to adopt some "novel" expedients in the emergency, the job was expertly engineered. Equipment was selected against a measurement of the cubic space of the library and was arranged to provide between five and 10 complete changes of air every hour. [Photo courtesy Carrier Corp.]

AFTER $5 MILLION FIRE at Michigan's state office building, Lansing, dehumidification equipment was installed to save water-soaked volumes in the state library. Ron B. Garlock and M. L. Baldwin directed the work



HEATING DISPATCHER Walter Hazell gets a complaint about lack of heat in one of the shops

HE SHOWS HEATING COORDINATOR Vernon Patterson the area in which the complaint originated

How Boeing Saved $100,000 in Cost of Heating

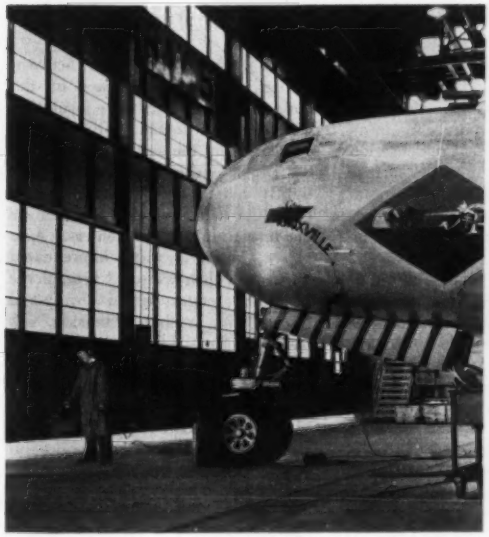
Heating the Boeing Airplane Co. plant in Seattle cost nearly $100,000 less last year than previously because of an unusual program initiated by the plant engineering department. How the scheme works is told here in words and pictures

THE HEATING BILL of the Boeing Airplane Co. at its main plant in Seattle was nearly $100,000 less for the year ended February 28 than for the previous year — a reduction of 25 percent — as the result of an unusual program initiated by the plant engineering department. The saving was accomplished with no loss in comfort and with an additional personnel cost of only $1200 a month for maintenance heating coordinators.

The program is aimed at the avoidance of heat waste. In the past, although temperature was supposed to be maintained at 72 deg in office areas and 65 deg in the plant, control was loose and workers who objected that they felt cold usually were able to have the heat adjusted to any degree they desired. If they found the temperature too high, they simply opened the windows to let heat out.

Under the new program, specified temperatures are rigidly maintained. This made some trouble at first, but W. B. Pride, chief heating and ventilating engineer, usually was able to meet complaints by installation of instruments which recorded temperatures and by graphs showing temperatures at which working efficiency was highest, etc.

The program has not been forced upon employees with no chance for recourse. The employee who feels a draft or finds his working area too hot, cold or stuffy is urged through the company's weekly publication to speak to his supervisor, who then telephones the maintenance heating



"HEAT-RUN MAN" uses a smoke instrument to determine extent of draft which led to the complaint

W. B. PRIDE, chief heating and ventilating engineer, is asked for advice on another heating problem

dispatcher. During the first shift, this dispatcher takes only heating and plumbing calls. On the second and third shifts, one dispatcher takes all maintenance calls, including those relating to heating.

Heating Coordinator On the Job

The dispatcher puts a maintenance heating coordinator on the case. The coordinator goes to the spot and tracks down the trouble, correcting it immediately if possible.

For example, if the complaint is about too much heat, he may simply adjust the thermostat to turn off the heat at a slightly lower temperature. If the workers complain their area is too cold, the coordinator installs instruments to record the temperature throughout the day. If a draft is the cause of the trouble, he may install a deflector or have the ventilation throttled down. Occasionally, if some person seems particularly susceptible to drafts the coordinator may urge the supervisor to move that person to another location.

The coordinators and dispatchers, all of whom work the year around, report directly to the general foreman of heating and plumbing. They work closely with plant engineering, however, and consult that department on difficult problems.

Working with the coordinators are four "heat-run" men who are constantly on the go throughout the plant — two during the first shift, one each on second and third — checking temperatures and, whenever necessary, changing controls, opening or closing valves, starting or stopping fans, etc. Since the plant, with 51,724,062 cu ft of space, has 30 miles of steam piping, with several hundred valves, thermostats and controls, the heat-run man has a big beat to cover. The first-shift men also repair thermostats while those on the second and third shifts do some maintenance work.

On the day shift, some heat is saved by seeing that large doors of warehouses, tunnels and other areas are closed when not in use. On the second and third shifts, as well as on week-ends, the problem resolves itself largely into seeing that the heat is turned off in areas where not required. Freezing is seldom a danger, the weather being such that round-the-clock heating is required only one or two weeks a year. A great deal of heat is saved by turning the heat on at the right time in the morning — early enough to assure comfort but not so early as to waste heat.

Boeing found that greater economies can be effected from March through October than during the winter months, because more heat is being wasted. In the colder months, the heating plants are running close to their rated capacities and there is less heat to waste — most of it being needed. When the weather warms up, the heating output is reduced but it may be wasted by opening the windows rather than shutting off the heating units, for example.

When the coordinator finds windows open and the heat on, he turns off the heat on the theory the temperature is higher than needed. He frequently is reminded that each extra degree of heat above 70 deg boosts the heating bill 3 to 7 percent, depending upon the outside temperature.

Since the controls largely are hand valves, much is left to the discretion of the coordinators. This is particularly true during the spring and summer, when outside temperature has an important relationship to inside heat. When outside temperatures reach 65 deg, comfort heating mains are shut off.

Many Heating Methods Are Used

The great variety of heating arrangements throughout the establishment does not permit hard-and-fast rules. In engineering areas, for example, many persons work in the

same large room, making it impossible for each employee to regulate the heat just the way he might like. Such areas have regulation, constantly watched by a designated person, in addition to the automatic controls. Individual attention is required, of course, in the smaller areas with their own heating units.

Automatic regulation generally prevails in the larger working areas, served by forced air heating, while manual regulation prevails in the smaller areas, usually at the fringe of the plant or at the airport across the street from the main plant.

The Boeing heating system is so complicated and far-reaching that central control is felt to be economically impossible. It includes finned tubing and convectors, with low and high pressure steam, 1 to 100 lb distribution pressure, and vacuum pumps; forced warm air for combined heating and ventilating; electric radiant cable buried in walls and ceilings of small areas which are otherwise difficult to heat; electric convection heaters in walls; electric fan heaters; overhead projection and unit heaters, some revolving, throwing the heat down as far as 50 ft; direct fired units with 500,000 and 600,000 Btu output; a portable flash boiler, 100 lb pressure, for heating planes on the field; and ordinary heating stoves in a few isolated areas.

Boeing has two main oil fired boiler houses with high pressure steam boilers, requiring 10 boiler operators for these and the auxiliary installations. Maximum output is 110,000 lb per hour of steam, all of which may be needed for heating at peak periods and none at times in the summer. As much as 40,000 lb of steam may be needed for process purposes for very short periods.

Exhaust systems move about 1,000,000 cfm of air, of which 15 percent is recirculated. Since each 1000 cfm of recirculated air represents a saving of $35 per 8 hr shift per year, Boeing is attempting to increase this percentage.

Meters are used to measure the gross output of both boiler houses, with one meter for the five boilers in the north boiler house, feeding into a common main, and three meters for the three boilers in the south boiler house, feeding into as many mains. Meters also measure the heat received by each of the 16 buildings.

VAPORPROOFING GUARDS PIPE INSULATION

PROTECTION OF insulation from destructive moisture condensation is an important consideration in the effective insulation of piping containing low temperature fluids. Condensation of moisture may occur on the surface of pipe insulation when the temperature of the surrounding air exceeds the outside insulation surface temperature and relative humidity is high. To prevent accumulation of moisture in the insulation and consequent reduction of its efficiency, a vapor barrier is installed over the insulation and beneath the finish.

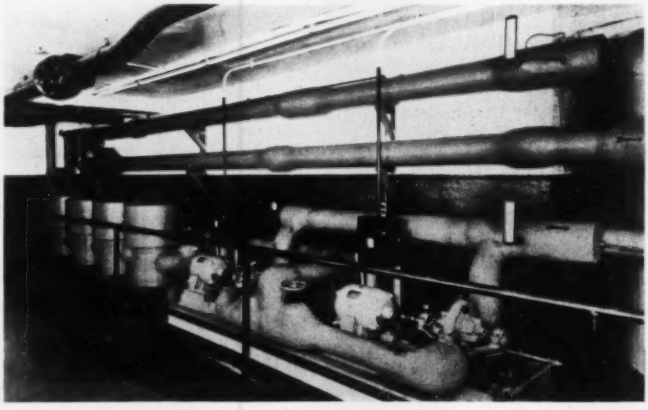
In the accompanying photo, three parallel cold water lines at the William Penn hotel, Pittsburgh, have been thoroughly insulated and carefully vaporproofed to insure long, maintenance-free service in a basement area where surrounding air temperature and humidity are high.

All three of the horizontal 4 in. pipe lines are covered with 1½ in. thick molded type mineral wool sectional pipe insulation. Pipe fittings are covered with 1 in. thick mineral wool felt insulation and a 1 in. layer of insulating cement. The lower insulated pipe supplies circulating ice water. The long insulated pipe section in the middle supplies city water to the refrigerating system. The top length of piping is a section of the ice water return system and feeds circulated ice water to the refrigerating units for recooling.

For each run of pipe between fittings, the inside surface of the molded type sectional pipe insulation was heavily coated with asphalt emulsion and the sections pressed on the pipe. Adjoining sections were tightly butted together and secured with jute twine spirally wound over the insulation on 4 in. centers. As a vapor barrier, wax impregnated paper was then wrapped around the insulation, edges lapped 3 in., and sealed with asphalt emulsion. A hard base for the finish was provided by a layer of rosin sized paper wrapped and sealed over the wax impregnated wrapper. Eight ounce canvas was pasted over the rosin sized paper and two coats of oil paint applied to finish the installation.

Felt type insulation was tightly wrapped over the pipe fittings, bound with jute twine and covered with two ½ in. layers of mineral wool insulating cement, both layers being allowed to dry thoroughly. A thick vaporproofing coat of asphalt emulsion was then trowelled on over the cement. After drying, the fittings were finished with 8 oz canvas and two coats of oil paint. The sectional type pipe insulation was applied before the fittings were covered and care was taken that the insulation on the fittings joined with the adjacent pipe insulation and formed a continuous smooth surface to receive the vaportight finish.

THREE COLD WATER LINES at the William Penn hotel were thoroughly insulated and carefully vaporproofed to insure maintenance-free service, as indicated in this photo from the Industrial Mineral Wool Institute



Oil and Burner Performance Discussed at OHI Session

Catalytic Cracking an "Important Forward Step"

CATALYTIC CRACKING methods represent an important forward step in the oil industry, for they provide relatively large amounts of high octane anti-knock gasoline, larger amounts of fuel oil than obtained by straight distillation, and catalytically cracked distillates are less unstable than those produced by other methods, said H. C. Hunter, chief product development engineer, fuels section, Gulf Oil Corp., at the engineering session during the 28th annual convention of the Oil-Heat Institute of America.

Almost 2,000,000 bbl per day of catalytically cracked distillates are now being used. While these oils were formerly unstable in storage and unreliable in burning, these adverse qualities have been largely overcome, he said. These newer oils may be used satisfactorily with high and low pressure atomizing burners and rotary burners. Filters, and inhibitors added to the oil, are effective in solving the problem of sludge formation.

Any great increase in the size of our armed forces will mean greater demands for gasoline, it was pointed out at the session. This will result in more fuel oil, but the armed forces will require tremendous quantities of various oils so that there may be smaller amounts of heating oils available. Under conditions imposed by a greatly increased size of our armed forces, there would be enough heating oil to keep buildings "livable," it was said, although it is doubtful if there will be enough additives or inhibitors — which would mean poorer quality oils and consequent servicing problems.

Eight Rules for Preserving Boiler Tubes

In his paper on the care of tubes in low pressure oil fired boilers used for heating systems, H. F. Hinst, chief metallurgist, welded tube division, Babcock & Wilcox Tube Co., gave eight rules for obtaining longer tube life in steel boilers: (1) Keep air out of the system; (2) As soon as possible after installation, use an alkaline cleaner to remove oil from tube surfaces, as tubes are generally oil coated for protection during storage and transit and the oil has a corrosive effect; (3) Soon after installation bring the boiler to a good steam output (for hot water boilers, heat to 180 F) to deaerate the system; (4) Use sodium chromate or caustic soda to control the pH value — a value of 11 is recommended; (5) Use a low sulphur content fuel; (6) Brush, flush and dry out boiler tubes as often as possible; (7) During shutdown periods and where the surrounding air has a high relative humidity, place a box of unslaked lime in the ashpit to absorb moisture; (8) Prevent water leaks and do not drain the system periodically.

Recommends Oil Burner Research

B. A. Landry, supervisor of fuels research, Battelle Memorial Institute, stressed the need for research in the oil burner industry. He said that ability to control the air-fuel ratio is fundamental, and stated that each must be controlled separately and that burners must be able to control the droplet size of atomized oil. The importance of turbulence was brought out, and after stating that control of it would go a long way toward good combustion with low excess air, Mr. Landry said that simple and adjustable controls for this purpose are highly desirable.

Problems of reverberations or pulsations were also covered, and it was explained that burners generate oscillations which are amplified by resonance in the furnace. In the speaker's opinion, fundamental data with respect to vibration are available and could well be used to solve this problem.

Progress in evaluating fuel oils was discussed by D. W. Locklin, in charge of research and development work in oil combustion for Timken Silent Automatic Div., Timken-Detroit Axle Co. His paper constituted a report of an investigation carried out at the laboratory of the American Society of Heating and Ventilating Engineers, in cooperation with the OHI. Mr. Locklin was formerly a member of the ASHVE laboratory staff.

The investigation was made to determine the extent to which a fuel oil combustion test unit designed by the OHI could be used to distinguish between and reproduce the burning qualities of different fuel oils as indicated by smoke density and flame length at a given percent CO_2. Five of six oils tested gave satisfactorily reproducible results. A detailed report of the investigation was published in the ASHVE Journal Section in the December 1950 HPAC.

Field Engineer's Job Important

The purposes of field engineering were discussed by G. E. Seidel, of Minneapolis-Honeywell Regulator Co. In his opinion, the manufacturer's technical representative of the war period has become the field engineer of today. During the war his job was to keep war equipment going, to help train personnel of the armed forces and — more important — to provide the home office of his company with valuable data.

Today his job is to provide a reliable exchange of information between the field and the home office. He helps to pin-point research and development and he brings excellent technical assistance to the field. In Mr. Seidel's opinion, he should spend one week out of six at the home office comparing notes with other field engineers and with home office personnel.

Determination of Burner Performance

J. A. Stein, chief engineer, Bacharach Industrial Instrument Co., described the basic principles of fuel oil combustion and indicated that the causes of smoke are poor fuel vaporization, impingement, insufficient air and a poor mixture of air and vapor.

He demonstrated that smoke is a most important combustion product and that its measurement, along with stack temperature and percent CO_2 in the flue gas, aids materially in establishing a true index of oil burner performance.

L. N. Hunter, vice president in charge of research, National Radiator Co., presided at the engineering session.

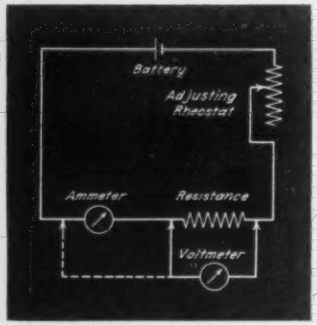


FIG. 1—BASIC CIRCUIT for evaluating resistance. Resistance of voltmeter should be large compared to the unknown resistance

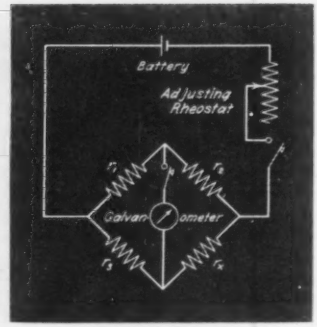


FIG. 2—WHEATSTONE BRIDGE circuit offers much more rapid method of measuring resistance than does circuit of Fig. 1

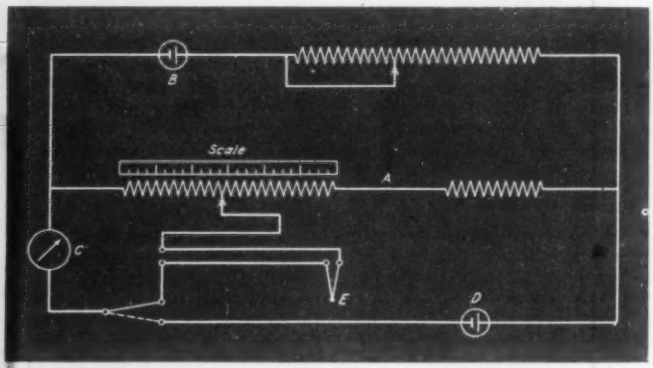


FIG. 3—POTENTIOMETER CIRCUIT compares voltages or potentials, generally with a galvanometer to indicate when balance is secured

Electrical Fundamentals and Their Use in Instruments and Control

By Kalman Steiner

Basic principles of electricity and electrical circuits used in some of the instruments and controls employed in heating and piping systems are clearly described. Future articles will go further into this important subject. The author has had wide experience, is a member of HPAC's board of consulting and contributing editors, and is with C. Hoffberger Co. (coal, fuel oil and burners, and ice)

THE FAMILIAR Ohm's Law relationship of voltage, current and resistance in a direct current electric circuit has been applied to many boiler room and other instruments. Probably every engineer at one time or another has made use of voltmeters and ammeters for determining the resistance of an electrical circuit or a portion of it. This same relationship — that voltage equals the product of current and resistance ($E = IR$) — is the basis of a number of equally useful but somewhat more complex determinations that are of interest to the operating engineer. By means of resistance evaluation, resistance balance or voltage balance, it is possible to measure such diverse quantities as CO_2 content of flue gases, smoke density in a boiler uptake, purity of condensate return water, hydrogen ion concentration (pH) of boiler feedwater, or firebox temperature.

It is the purpose here to review some of the fundamental concepts of electrical resistance balancing and some types of apparatus employing such balance.

Basic Circuit for Voltage Drop Measurement

In Fig. 1 is shown the basic circuit for measuring voltage drop across a resistance. In such a determination, the temperature of the unknown resistance must remain constant, which implies that it be at room temperature unless it is completely insulated against heat loss or gain. The resistance of the voltmeter should be large compared to the unknown resistance so that current flow through the voltmeter will be negligible; then, with the ammeter connected as shown, it will record current flow through both resistance and voltmeter but no appreciable error will result.

The only way to remove the voltmeter current entirely from the reading would be to connect as shown by the broken line, in which case the voltmeter reading would include the voltage drop across the ammeter. For refined measurement, it is advisable to take readings both ways, and to adjust the control resistance to give a current flow that will eliminate the meter errors or reduce them to a negligible value.

A much more rapid method of measuring resistance is afforded by a combination of conductors called the

Wheatstone bridge, Fig. 2. The unknown resistance is evaluated by direct comparison with a standard resistance; therefore, no calibrated meters are required, the balance being secured by bringing a galvanometer into zero deflection. The current supply of a battery will suffice for such a circuit, and minor variations in the supply will not affect the readings.

The bridge is an arrangement of resistances whereby the current from the battery is split into two paths. When the division of the current is equal, no current flows through the galvanometer. Hence, if r_1, r_2 and r_3 are adjusted until the galvanometer deflection is zero (the null or balanced state), then the unknown r_x may be evaluated as $r_2 r_3 / r_1$. By using calibrated resistances, the values of three resistances used to attain balance afford the means of calculating the fourth or unknown.

Applications of Wheatstone Bridge

The most usual application of the Wheatstone bridge is in null methods, where balance is indicated by zero deflection. However, in the case of certain instruments — the resistance thermometer, for example — no attempt is made to balance the circuit but instead the galvanometer is calibrated so that its deflection shows the temperature.

The deflection reading is also used on CO_2 meters, as will be seen below. When so used to indicate a temperature or other physical measurement, the galvanometer is usually called a millivoltmeter. The d'Arsonval galvanometer or millivoltmeter is an extremely sensitive and accurate instrument, although it is also a delicate mechanism. The pointer of this instrument is attached to a movable coil that is supported on jeweled bearings between the ends of a permanent horseshoe magnet, with springs arranged to lead current into and out of the coil. These springs also serve to support the coil and control its deflection. The pointer moves over a scale that indicates the magnitude of the deflection, the deflection being proportional to the impressed voltage. Sufficient torque to move the pointer a full scale length, in a typical instrument, is developed by an impressed voltage of 50 millivolts. For work with higher voltages, a series circuit with a high resistance is employed so that perhaps only 1/3000 of the actual voltage drop occurs through the instrument coil. The millivoltmeter can be adapted to recording or controlling.

Fundamental Circuit for Potentiometer

The potentiometer is a device that compares voltages or potentials, generally with a galvanometer to indicate when balance is secured by zero deflection (null method). The fundamental circuit, shown in Fig. 3, comprises a conductor A of uniform cross section throughout its length, a battery B imposing a voltage across A, and a galvanometer C that can be connected either through a standard cell D or through an unknown voltage E. First, the standard cell voltage (which is accurately known) is opposed to the battery B voltage. The portion of resistance A required in the circuit of D to give balance or zero deflection is noted; then the switch is thrown to substitute the unknown E for D, and again that portion of A required for null is noted. The unknown voltage equals the standard cell voltage multiplied by the ratio of the two portions of A previously noted. The voltage so determined may be an indication of temperature, or pH or some other quantity.

Applications of These Methods

To illustrate some applications of these electrical measuring methods, a few typical pieces of apparatus will be described. Each is based upon the use of one or more of the electrical balancing or measuring instruments discussed.

Some years ago a bulletin of the National Bureau of Standards described a method for the determination of constituents of gas mixtures based on the variation of thermal conductivity of the mixture with variation in the composition. [Technical Paper 219, Thermo-conductivity Methods of Analysis, by Palmer and Weaver] This principle has been employed in commercial forms of flue gas analyzers.

Fig. 4 shows the basic wiring scheme. Two cells containing platinum wire resistances are arranged so that gas may pass through them. Two more resistances and a galvanometer are incorporated in the circuit to make a Wheatstone bridge. Electric current from the battery, sufficient to raise the temperature of the two platinum coils and the bridge, is brought into balance. A stream of flue gas is then passed through one cell and air through the other.

As the electric conductivity of the platinum coils is affected by their temperature, any change in the coil temperatures will change the current flow and upset the bridge balance. Of the gases that can be present in flue gas in significant quantities, carbon dioxide alone has a thermal conductivity appreciably different from that of air. Hence, the transfer of heat from the platinum coil of that cell

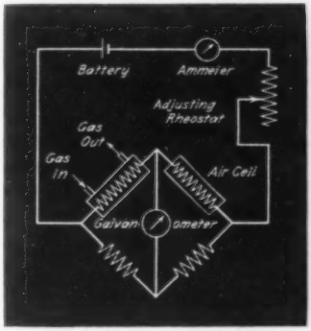


FIG. 4—THERMAL CONDUCTIVITY CO_2 meter is used to determine percentage of carbon dioxide in flue gases, is quite sensitive

through which flue gas passes will be directly dependent upon the percentage of CO_2 in the flue gas. The deflection of the galvanometer is proportional in turn to the difference between the temperatures of the two coils and hence to the percentage of CO_2 in the flue gas. It is important when using this equipment that the ambient temperature be held constant, since the thermal conductivity of a gas is a function of its temperature. Sensitivity of these analyzers can be close as 0.01 percent.

Thermal conductivity CO_2 meters are built in both portable and mountable styles. The galvanometer deflection in either indicates the percentage of CO_2. It is also possible to secure a recording of CO_2 percentage by providing a potentiometer of the recording type connected to the bridge, the amount of bridge unbalance resulting from change in gas composition being measured and recorded by the potentiometer.

Protecting Piping Systems

Another interesting application of the Wheatstone bridge is the condensate purity meter. Few steam-condensate piping systems are free from sources of contamination. In the case of process applications, where steam is used for drying, and in steam kettles, etc., there is always possibility that small leaks can permit substances that might injure the boiler or piping system to mingle with the condensate.

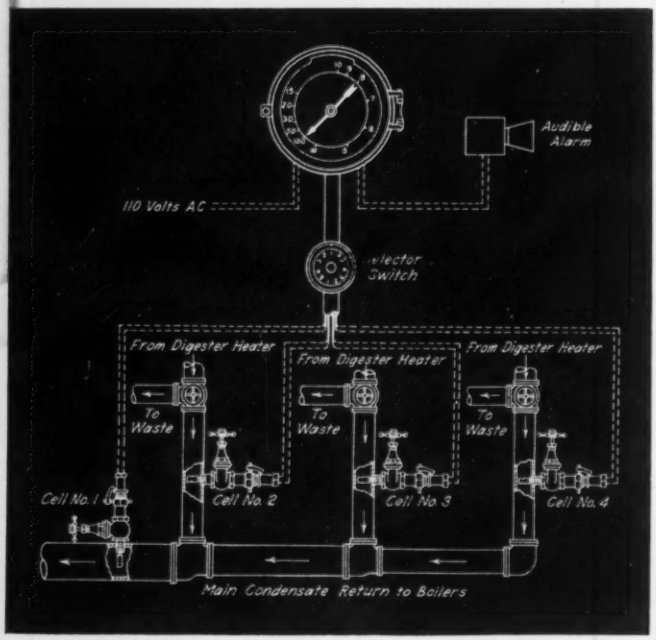
It is the function of the condensate purity meter to detect the presence of inorganic chemicals in the condensate. These meters are made in various styles — to signal by flashing a light or sounding an alarm, to record the concentration of impurities, to control by causing a valve to open or close, or a combination of two or more of these tasks. Such meters are based upon the same fundamental circuit, a Wheatstone bridge in which the conductivity of the condensate is used as a measure of the concentration of impurities.

Fig. 5 shows a typical hookup for a system draining condensate from three digester heaters at a paper mill. There is a conductivity cell in each of the three branches and a fourth in the main. Should digester liquor leak into the condensate, the instrument sounds an alarm. The operator then turns the selector switch to disconnect cell No. 1 from the recorder and to connect sucessively cells Nos. 2, 3 and 4. The defective unit is thus identified and can be diverted to waste, or a system of automatic control can be incorporated to operate motorized valves.

Still another application of the Wheatstone bridge of use in boiler water treatment is the photoelectric colorimeter. While of course it finds usefulness in many other fields, its use in boiler water chemistry is of special interest to the operating engineer. In addition to the bridge, the circuit involves a rather complicated electronic arrangement, so no attempt is made to describe it here. By means of this colorimeter, very accurate determinations of pH can be made through colorimetric methods, as distinct from electrometric methods, mentioned below [see Steiner, pH — What It Means and How It's Measured, HPAC, January 1944].

The thermocouple pyrometer requires an instrument for measuring the electromotive force which it generates at various temperatures, and which "emf" is used as the index of temperature. Two types of instruments are widely used — the d'Arsonval millivoltmeter and the potentiometer. The millivoltmeter is more commonly used on portable types and the potentiometer on mounted installations. There are many styles of thermoelectric pyrometers, necessitated by the great variety of uses to which the instruments are put. [An excellent discussion of pyrometry will be found in the book, Industrial Instruments for Measurement and Control, by Rhodes]. Thermocouples work well at temperatures ranging from −100 F to 2400 F (though no one couple covers the entire range). For temperatures below 300 F, the resistance thermometer, embracing a Wheatstone bridge circuit, is frequently used. For higher temperatures, above 2800 F, it is necessary to use optical instruments — one form of radiation pyrometer employes a galvanometer.

FIG. 5—CONDENSATE PURITY METER is an application of the Wheatstone bridge, has numerous uses in various industrial processes



Smoke Indicator and Recorder

An interesting application of the potentiometer is found in the smoke indicator and recorder of the type shown in Fig. 6. Two streams of flue gas, taken from different points of the stack, are merged and a beam of light is passed through the mixture. The light source is a voltage-controlled bulb. The light which penetrates the gas mixture falls upon a thermopile, or series of thermocouples. The energy of the incident light varies inversely to the concentration of smoke. The lens of the thermopile concentrates the rays upon the thermocouples, and an electromotive force is generated. The potentiometer measures the emf, and is thus essentially a pyrometer having a multiplicity of thermocouples. In addition to indicating the smoke intensity and recording the values on a chart, the system can also include warning signals located at any desired places in the plant.

Controlling Water Treatment

One of the most effective applications of a potentiometer in the boiler room is the control of chemical water treatment. While the chemical reactions involved in the average

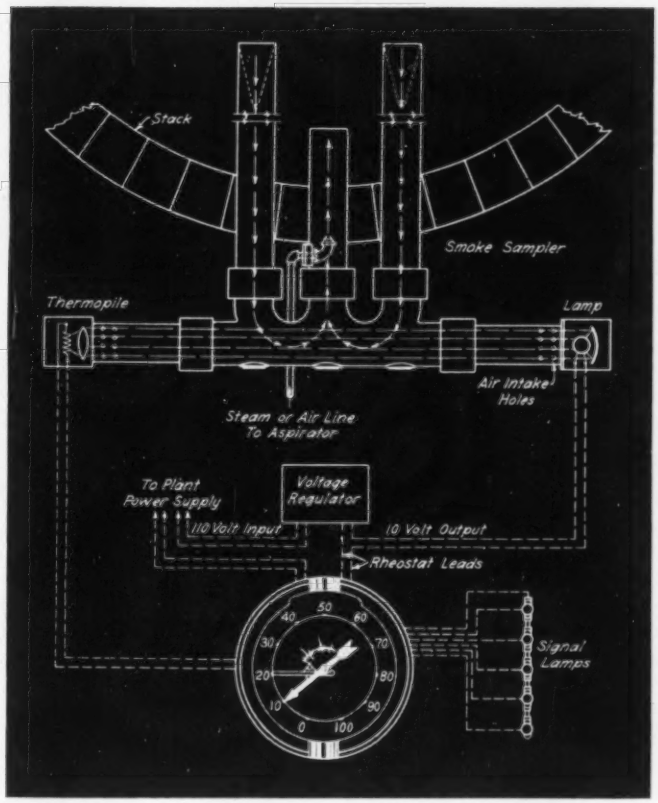


FIG. 6—SMOKE DENSITY indicator, recorder and alarm method diagrammed here uses potentiometer as explained in text

lime-soda water softener are not complicated, the average operating engineer is not necessarily versed in chemistry, so that the regulation of the process by means of simple titrations might easily be the weakest link in the sequence. It is possible to control the process automatically through the medium of potentiometer response to changes in pH.

There are several elements to the control system of a typical water softener setup. There is an electrode assembly in which a constant flow of the treated water is subjected to analysis by comparison of its conductivity or pH, a potentiometer for recording the pH value and transmitting required impulses to an intermediate relay or control unit, and a motorized chemical feeder which responds to the impulses originating at the potentiometer and relayed by the control unit. In this manner the rate of feed of chemical to the raw water is proportioned to the pH required for completion of the desired chemical treatment.

[Further articles on electrical fundamentals are planned, including a discussion of electronics and instruments and particularly flame protection and smoke detection.]

PROTECTIVE SHELTERS IN MODERN WARFARE

THE ARTICLE ON Protective Shelters in Modern Warfare, by Warren Viessman, published in the March and April issues, is interesting and timely. A number of comments, some perhaps obvious to many readers, may be made.

a) The efficiency of gas adsorption using activated carbon, or of filtration of particulate matter by suitable devices, is in no wise related to the radioactivity of the pollutants to be removed.

b) The filters and carbon adsorbers described will act as collection centers for radioactivity and, if combined with suitable detection equipment, can perform valuable functions as analytical devices to measure or monitor radioactivity of particulate and gaseous pollutants.

c) Effective working concentrations of triethylene glycol for bactericidal action have been stated to be in the range of 0.003 to 0.005 mg per liter of air (Jennings, Bigg and Olson, ASHVE Journal Section, September 1944 HPAC), differing considerably from the first figure of 1 g per 5,000,000 cc, cited by the author.

d) Water sprays, even without recirculation, cannot be considered to be effective for the removal of organic gaseous contaminants.—AMOS TURK, Director, Research and Development, W. B. Connor Engineering Corp.

REPLY BY AUTHOR—Mr. Turk's criticism of my article is appreciated.

In regard to his point (a), I am in agreement and have not been able to find that a statement has been otherwise made.

Point (b) is a contributory thought and should be published.

Point (c) considers the effective concentrations of gycol. The data of Jennings, Bigg and Olson are contributory and were considered by me. The questioned figure of 1 g per 5,000,000 cc was taken from Fundamentals of Bacteriology, third edition, page 461, by Martin Frobisher, Jr. (W. B. Saunders Co., publishers.) It was intended as an overall maximum quantity and is modified by case figures which follow.

In point (d), Mr. Turk takes exception to the removal of gaseous contaminants by water sprays. The effectiveness of water sprays for some gases was perhaps overstated in my original manuscript, but the statement in my published article reflects the situation accurately in my opinion.—WARREN VIESSMAN, Director, Heat & Power Div., U.S. Naval Civil Engineering Research and Evaluation Laboratory.

BIG AREA IN SMALL VOLUME

ONE POUND of "activated alumina," an aluminum chemical frequently used as a drying agent, has an internal moisture-blotting surface equal to 30 football fields, according to the Aluminum Co. of America.

No Water Shortage — But Water's In Wrong Places

A Brief Review of Some of the Papers Given at the Midwest Power Conference

THERE IS NO overall decrease in precipitation, and no *general* decline in water table levels over the entire country in areas *where the level is subject to natural conditions* rather than to use by man, said Frank C. Foley, district geologist with the U.S. Department of the Interior, at Madison, Wis., in his paper on ground water resources at the Midwest Power Conference in Chicago last month. However, the waste of water in the country as a whole is fantastic, he stated — "water is used once and then dumped into the sewer."

In commenting on the water shortages in many areas, one of the discussers of Mr. Foley's paper put it this way: There isn't any shortage of water, it's just not available in the right places.

Mr. Foley stressed the need for and importance of a water survey when determining the location of a new plant.

At the same conference session, Raymond C. Kelly, manager of the equipment division of J. F. Pritchard & Co. and president of the Cooling Tower Institute, stressed the increased usage of water by industry. Of the total water consumption in the average large industrial plant, 53 percent is used for cooling, 31 percent in process, 8 percent for boiler feedwater, 5 percent for sanitary purposes and 3 percent for miscellaneous demand, he said.

The cooling tower industry is dedicated to improvement in the technology, design and performance of water conservation equipment, Mr. Kelly said. On this foundation, the formation of the Cooling Tower Institute was recently completed. The institute hopes to share with industry responsibility of encouraging action on those steps necessary to avoid experiencing, as did the Union of South Africa, "an industrial slowdown because of an acute shortage of the most valuable mineral of all . . . . water", he stated.

He called the attention of his audi-

ACCEPTANCE TEST PROCEDURE FOR MECHANICAL DRAFT TOWERS

Tests may be made by the Purchaser, under actual operating conditions, with the use of the following data and information

TABLE I
Design Data

DESIGN CONDITIONS
GPM _____ °F.
Hot Water _____ °F.
Cold Water _____ °F.
Wet Bulb _____ °F.

TABLE II
Tower Test Factor

COOLING RANGE	APPROACH TO WET BULB*				

TABLE III
Wet Bulb Factor

WET BULB	FACTOR

*Manufacturer shall be allowed a plus tolerance of 5% or ½° F, whichever is greater.

Performance may be calculated from data with above tables and following equations.

Design Performance = Design gpm × Tower Test Factor × Wet Bulb Factor.

D.P. = _____gpm × _____T.T. Factor × _____W.B. Factor = _____

Test Performance = Actual gpm × Tower Test Factor × Wet Bulb Factor.

T.P. = _____gpm × _____T.T. Factor × _____W.B. Factor = _____

When substitutions are made in the above equations, the "Performance Ratio" is

$$\text{Performance Ratio} = \frac{\text{Test Performance}}{\text{Design Performance}} = \frac{\text{T.P.}}{\text{D.P.}} = \_\_\_\_\_$$

If this ratio is more than One, the tower exceeds the design performance; if the ratio is less, the tower performance may be adjudged deficient.

Before starting a test, tower operating conditions should be adjusted to approximate the design conditions (Table I) insofar as practicable. During the test, the tower shall be clean and reasonably free of scale, mud, algae, and oil. The water distribution shall be equalized for all parts of the tower. Tests shall be made during the daylight hours, fair weather, and with tower in operation at test conditions for sufficient time prior to start, to assure stable conditions. The date and duration of test, as well as number and frequency of readings shall be agreed upon. Operating conditions shall be within the following limits:

1. Gpm water, ± 10% of contract.
2. Constant gpm during the test.
3. Average wind not over 7 mph.
4. Wet bulb, as limited in Table III, trend during test 2° F.
5. Range as limited in Table II.
6. Range variation during test, ± 5%.
7. Water solids, below 5000 ppm.
8. Fan hp, as specified in the contract.

Tests shall be made within twelve months following tower installation. Wet-bulb reading for each test to be the average of wet-bulb temperatures measured on opposite sides of tower along longitudinal axis of tower at air intake, and not more than 6 ft. above basin curb and within 10 ft. of air intakes, and at no less than three points on each side. All test instruments to be properly calibrated.

Copyrighted, 1951, by Cooling Tower Institute Test Procedure Form No. TSC-101

ence to the copyrighted Acceptance Test Procedure for Mechanical Draft Towers, just issued by the CTI and reproduced by permission herewith.

Ground Coil Design for Heat Pumps

In a paper at the heat pump session of the conference, A. D. Kafadar, research engineer, Armour Research Foundation, and his co-authors, I. B. Fieldhouse and R. A. Budenholzer, said that the reason the heat pump is not more widely used, despite its promising future, is that the problem of finding a suitable source of heat for the evaporator coils has been very difficult. Until a few years ago the only heat sources given consideration were outside air and well water. The former is unsuitable in the colder regions of the United States, where the temperature often drops below freezing, and the latter is suitable where available, but the large quantity of water required eliminates its use in many localities, they said.

Recently, a great deal of attention has centered around the possibility of using the ground as a source of heat and the results at present appear very favorable, especially for rural and suburban installations where a moderate amount of land is available for heat withdrawal. However, there are still many engineering problems to be solved regarding the use of the earth as a source of heat. One of them is knowledge of the temperature distribution around a pipe buried in the ground for withdrawing heat. This knowledge is essential for predicting the coefficient of performance and capacity of a heat pump using the earth as the heat source.

As heat is withdrawn from the soil it is possible that the moisture in the soil surrounding the pipe will freeze. They discussed the effect of the freezing of moisture in the soil on the temperature distribution around a pipe when withdrawing heat at a constant rate from the surrounding earth, and their paper presented a method for predicting the radius to which the soil is frozen and for calculating the performance of a heat pump when freezing in the soil occurs.

In his paper on analysis of experimental ground coil data for heat pump design, William Parkerson, rate engineer, Middle West Service Co., pointed out that the theory of heat removal from the earth by means of a buried coil has been adequately developed by several competent mathematical physicists, but that all of this theory has failed so far to supply the design engineer with a satisfying design formula — one which is well supported by experience data.

To be sure, he said, a mass of experimental data does exist, which has been gathered in the field under normal operating conditions. But it still remains for someone to fit together into a usable pattern the experimental data and the mathematical theory.

Mr. Parkerson then presented an analysis correlating experimental data and theory, and expressed the hope that others would make similar studies and correlations. Then, at long last, he concluded, the design engineer "would have a design formula on the basis of which he could select equipment with confidence."

The Midwest Power Conference is sponsored by Illinois Institute of Technology with the cooperation of several other universities and colleges, the local sections of a number of engineering societies, the Western Society of Engineers, the Engineers' Society of Milwaukee, and the National Association of Power Engineers.

PLASTIC CURTAIN CUTS BOWLING ALLEY COOLING LOAD

A SAVING OF one-third in the cooling requirement of ta Boston bowling alley was effected by hanging a 4 ft plexiglass curtain from the ceiling between the public area and the alley area, according to Anthony Erbetta, of the Boston Air Conditioning Co.

Load calculations for a 14 alley section of the Lucky Strike Bowladrome showed a 15 ton cooling requirement for a 15 deg temperature drop. However, use of the curtain along the full width of the alleys at the foul line to obstruct the flow of cold air over the alleys enabled use of a 10 ton packaged unit. Ducts above the ceiling carry the cool air to six 670 cfm three-directional diffusers, spaced at 10 ft intervals, 4 ft in front of the plexiglass curtain.

The cooling unit, which contains a built-in evaporative condenser for water conservation and a steam coil for winter heating, was installed against the outside wall of the building. Outdoor air and condenser air and exhaust are taken directly through the wall.

The owner, Joseph Bonigli, a former champion bowler, is so satisfied with the operation of the system that he has ordered a 7½ ton upright conditioner to cool the other section of the Bowladrome, containing 10 alleys. [Photo courtesy United States Air Conditioning Corp.]

PLEXIGLASS CURTAIN hanging from ceiling above foul line enables use of 10 ton rather than 15 ton conditioning unit for 14 alley section of Bowladrome

How To Get Top Efficiency from Compressed Air Power

By Edmond C. Powers, Educational Director
Compressed Air and Gas Institute

Piping serves American industry in many ways, and one of its most important production and maintenance operations is in making compressed air at the proper pressure and in the proper amounts available at the right points of use. Manpower, material and equipment shortages stress today's need for getting peak efficiency from compressed air power systems

IF A PLANT SURVEY has determined that the present air compressing equipment and distribution piping systems are inadequate to meet production demands when they are operating at peak efficiency, the problem becomes one of selecting additional air compressors, air operated tools and accessory equipment.

Selection of the particular type of compressor — that is, reciprocating, rotary or centrifugal — should be based on careful study and should include consultation with manufacturers whose engineers are qualified to make recommendations.

Before finally determining the precise type of compressor to be installed, consideration should also be given to the various types of power used to drive compressors — electricity, steam, oil, gas or gasoline. The type of drive deserves careful study from the standpoint of first cost, operating cost, reliability of power or fuel supply and maintenance. Anticipated plant load factor will also occasionally have a bearing on the selection.

Manufacturers of compressed air equipment maintain trained staffs qualified to advise on specific problems in the generation and distribution of compressed air power and compressed gas.

Objective of the Installation

The object of installing a compressed air plant is to provide a sufficient quantity of air to the work at sufficient pressure for efficient operation.

Before attempting to determine the amount of compressed air necessary, a thorough study should be made to provide for the use of air power in all applications for which it is suitable. The importance of this study in approaching the problem of installing the compressed air plant is obvious, since it will anticipate possible future needs as well as present uses.

The information obtained then becomes basic in approaching the problem of engineering the compressed air installation in any particular plant. In working out an installation, a series of analyses is recommended. These include the necessary compressor capacity, the number of compressor units, location of compressor units, regulation of the compressed air plant, and — last but not least — the compressed air distribution system.

Determining Necessary Compressor Capacity

The proper capacity to install is of course a vital question requiring careful analysis. A study of air operated devices in a typical plant will show that many of these devices operate almost continuously, while there are others which operate infrequently but require a relatively large air supply when in use. It will also be discovered that the actual amount of air used by the individual device will vary considerably in different applications.

The first suggestion is, therefore, that the average air consumption of air operated tools be ascertained. This may be obtained from manufacturers' literature or may be closely approximated by actual test. Care must be taken not to assume that all air operated devices consume their maximum under all conditions as otherwise a false plant size will be developed. Therefore, the load factor of the device must be considered.

Relatively few air powered devices use air continuously. Pneumatic tools of all types, rock drills, hoists, blow guns, etc., operate intermittently and their *net* air consumption is considerably less than their maximum. The ratio of *actual* air consumption to the maximum continuous full load air consumption is known as "load factor."

The second item in load factor will depend on what might be called the "work factor," or the percent of maximum possible work output per minute which is actually done by the device. For example, the air consumption of a grinder with full open throttle varies considerably, depending upon how hard the operator pushes it against the work. The work factor is therefore the ratio of the air consumption at the actual conditions of operation to the air consumption when the tool is fully loaded.

"Load factor" is actually the product of "time factor" and "work factor."

In one shop studied, for 34 separate portable tools on production work, the actual air consumed was only 15 percent of the supposed full-time rated air requirements.

In a large shipyard with several thousand portable tools, the actual load was only 7.6 percent of the load which might be expected, based on the total tools in operation, plus stock and reserves. As a matter of fact, this yard carried many extra tools. If the air supply had been figured correctly on the tools actually in use, the air required would be 15 percent of the requirements for the tools in use.

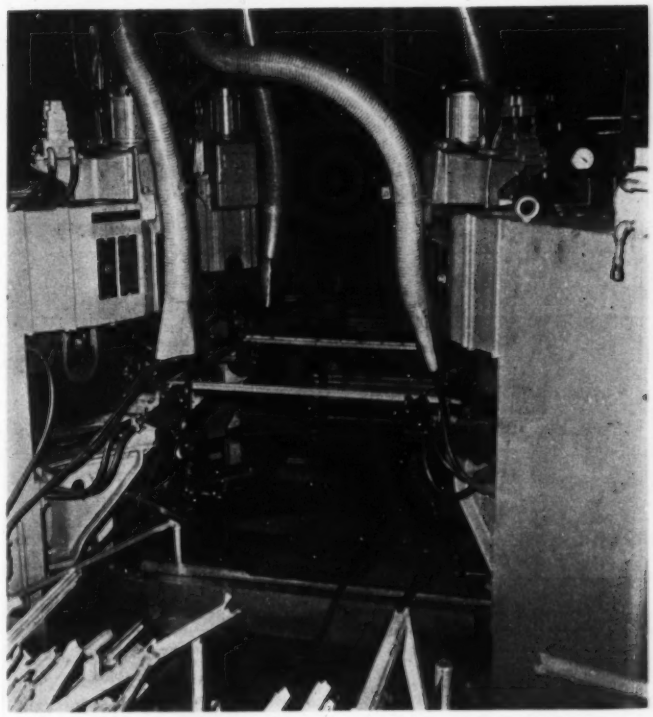
In determining load factor, care should be taken to eliminate the tools on hand in the storeroom or not in use. It is wise to discuss these points in detail with the tool manufacturer before finally deciding on the actual air consumption needed.

The above remarks apply to the more steadily operated air tools and appliances. A study of the uses of air power which cause heavy but usually short-time demands will develop added capacity required for these operations. The possibility of storing air in large receivers should be considered, although this can be helpful only to provide for peak demands of very short duration.

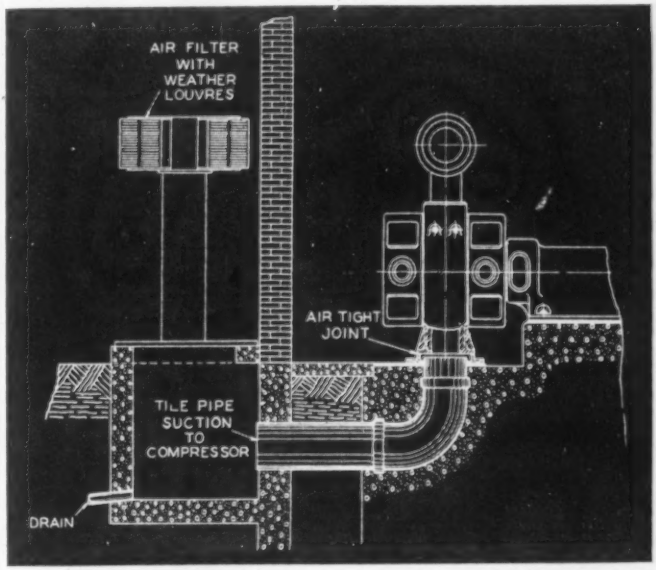
Allowing for Piping Leakage

Some comment should be made on the practice of adding a percentage to calculated compressor capacity to provide for piping leakage. This has been due largely to the fact that compressed air is so harmless that it is not considered vitally necessary for an air system to be tight. Electrical lines must be carefully insulated — leaks cannot be tolerated. Steam lines are kept tight because of danger and also because steam leaks are objectionable. Refrigerating systems must be tight, both because leakage is expensive and the gas is frequently obnoxious.

There is no more justification for allowing compressed air wastage than there is in buying a compressor without capacity control, letting it operate continuously at full capacity and discharging the surplus through relief valves to the atmosphere.



COMPRESSED AIR IS USED in manufacture of steel sash. Members of sash are placed in four-cornered welding arrangement, held securely during welding. Flexible tubes remove welding fumes



AIR FILTER ON INTAKE pipe to air compressor removes dust and foreign matter to prevent rapid wear of compressor's working parts. This sketch shows a typical installation

Specifications for horizontal type grinders

Type or size	With vitrified wheel: Wheel size,* in.	Maximum safe speed, rpm	With organic bonded wheel: Wheel size,* in.	Max. safe speed, rpm	Hose size recommended, in.
Pencil die grinder	Mounted points	40,000-70,000			¼
Die grinder	Mounted wheels 1x½x⅜	20,000	1½x½x⅜	24,000	¼
2 in.	2x1x⅜	12,000	2x1x⅜	17,000	⅜
Cone grinder	2-¼x3½x⅜	8,500			½
4 in.	4x1x⅝	6,000	6x⅛x⅝ 4x1x⅝	6,000 9,000	½
6 in.	4x1x⅝ 6x1x⅝	6,000 4,100	6x1x⅝ 8x1x⅝	6,000 4,500	¼
8 in.	8x1x⅝ 6x1x⅝	3,100 3,100	8x1x⅝	4,500	¼

*Three dimensions represent outside diameter, thickness and hole diameter, respectively.

Specifications for vertical type and disc sanders

Size, in.	Rpm	Wheel size, in.: Vitrified wheel	Organic bonded wheel	Sanding pad	Hose size recommended, in.
	3,600	Cup wheel, flared or straight 6x1½x⅝, or 6/4x2x⅜		5 and 7	½
6 Light	4,200	5		5 and 7	
	6,000		5	5 and 7	
	5,000		6x1½x⅝, or 6/4x2x⅜	7	½
	3,600	6x1½x⅝, or 6/4x2x⅜		9	¾
6 Heavy	4,500			9	
	5,000		6x1½x⅝, or 6/4x2x⅜		¾

Specifications for rotary type drills

Drilling capacity, in.	Free rpm	Morse taper socket	Air hose, in.
	For drilling in steel		
5/32	2500-15000 (For very light work)		1/4
3/16	1500-4500		1/4
1/4	1500-3000		1/2
5/8	1000-1500		1/2
9/16	600-1000	No. 1 or No. 2	1/2
7/8	500-900	No. 1 or No. 2	1/2
29/32	450-750	No. 2	5/4
1	450-650	No. 3	5/4
1-1/4	250-450	No. 3	5/4
2	100-450	No. 4	1
3	75-125	No. 4	1
	Wood boring tools		
1	750-1000		1/2
2	600-750		5/4
4	275-350		5/4

Specifications for chipping hammers

Piston stroke, in.	Piston diameter, in.	Length, in.	Weight, lb	Hose, in.	Work adapted for
1	⅞	8	5	½	Very light chipping
1⅜	1	10	8½	½	Light chipping and scaling
1	1⅛	11¼	10	½	Aluminum casting and light cast iron calking
2	1⅛	13½	13¼	½	Heavy cast iron; light steel casting; flue beading
3	1⅜	14½	14½	½	Heavy steel casting; billet chipping
4	1⅜	15¼	15¼	½	Extra heavy chipping

Specifications for riveting hammers

Piston stroke, in.	Piston diameter, in.	Length, in.	Weight, lb	Hose, in.	Size hot rivets in.
1	⅞	7¼	2¼	½	⅛
1½	1	9½	3½	½	5/32
2	1⅛	11½	11½	½	3/16
3	1⅛	14½	15	½	1/4
4	1⅛	15	18	½	5/16
4	1½	10½	2¾	¼	3/32-7/32
5	1⅛	16	19	½	5/16
5	1½	11½	3	¼	3/32-1/4
6	1⅛	17	20	½	7/16
8	1⅛	19	21	½	11/16
9	1⅛	20	22	½	13/16
11	1⅛	24	28	½	1½

Aircraft riveting hammers

Piston stroke, in.	Piston diameter, in.	Length, in.	Weight, lb	Hose, in.	Size rivets in.
2	⅜	8½	2¼	¼	1/16-3/32*
2	½	8½	2¼	¼	3/32-1/8*
3	⅜	9½	2½	¼	3/32-1/8*
3	½	9½	2½	¼	1/8-5/32*

*Refers to duralumin rivets (cold).

Previously, it has been customary to add an arbitrary item of about 10 percent for leakage. Compare this to an acceptable limit in the fuel gas distribution field of less than 1 cfm per mile of 3 in. line. Air lines can be made just as tight as other piping systems and can be kept tight. It pays to do so.

Before determining the final compressor capacity, consider carefully that once compressed air is available, its versatility will of itself lead to a magnitude of profitable uses and applications not originally anticipated. Although mechanically it is no problem to increase the size of a compressed air plant, since any number of units can discharge into the same system, it is prudent to provide some excess capacity for growth when the plant size is originally considered. This should include the piping system. What this excess capacity for future growth should be will depend largely on individual conditions and total known requirements.

It is less difficult to arrive at the proper capacity needed for a plant extension than for a new installation. Local experience, compressor load factors, tool load factors, etc. — either known or readily determined — provide a sound basis for decision.

When Is a Plant Overloaded?

The most frequent indication that more compressor capacity may be needed for an "overloaded" plant is *low air pressure*, which reduces shop production alarmingly.

Based on a careful log of the pressures throughout the production areas, present compressor operating load factors and peaks in demand (periods of unusually low air pressure), it is possible to determine with reasonable accuracy the additional compressor capacity required to maintain full air pressure at the working positions and thus increase tool effectiveness and production to the maximum. (Note: In all calculations compressed air measurement should be in terms of cfm of *actual free air.*)

Number of Compressor Units

The number of units into which total capacity should be divided is important. Air compressors are

sturdy machines but (like all mechanical and electrical equipment) they require maintenance and must occasionally be taken out of service. Compressed air supply during maintenance periods is provided for differently in almost every plant. If the supply of compressed air is vital to continued production, the answer is usually determined by a comparison of the cost of standby capacity with the value of the production loss.

Many plants require a relatively small volume of air continuously, even when the plant is not in production. There should be a small unit of proper size to take care of such requirements as dry pipe sprinkler systems, oil burners on furnaces which must be kept hot over night or week-ends, air supply for tools used by plant maintenance crews over week-ends, etc.

Pneumatic tool manufacturers have developed tools with a wide range of power and speeds for the many different applications encountered. They also modify standard types to meet special conditions, even though the field for these semi-standard types may be small.

Selecting the Right Tool Accessories

The accessories to use with a pneumatic tool must be selected as carefully as the tool itself. Tool manufacturers can readily supply the necessary information for many kinds of work, but for special applications only experimentation will reveal the one best accessory and machine to use. Once determined, increased production and easy operation continue automatically.

Cone wheels are available in various sizes, grits and grades and should be operated at the maximum permissible speeds in order to obtain maximum efficiency.

Mounted points are frequently used with smaller high-speed machines to reach inaccessible places for fast, smooth finishes.

Sanding pads are available in 5, 7 and 9 in. sizes. Hard-grade felt pads and rubber pads are designated A, B or C, according to flexibility. The same sizes are also available in hemp fiber vulcanized with rubber in semi-flexible type only. The disc used with these pads varies in grit from No. 18 to No. 110 for different operations, and a careful selection of the proper grit will give rapid cutting combined with the proper grade of finish.

DRILLING CONCRETE SLAB with dust collector suction lead in place. Photo was taken while drill was operating, but note absence of dust at drill's tip

Cup wheels may be of the straight or flared type, the latter being used for getting into corners or descaling welds. Elastic bonded types are generally preferred.

Rotary files are usually used at somewhat reduced speeds and have proved very economical in small finishing operations. Speeds vary from 1000 to 3000 rpm on hard metals and may be much higher on the softer metals.

In general, the use of elastic bonded wheels operating at peripheral speeds of 9500 fpm will increase production.

Buffing wheels are used for finer finishing and are either the rag type, where facilities for proper coating are available, or other types using strips of sandpaper fastened in place to provide the cutting action.

Radial wire brushes are specified by diameter and gage of wire. Sections are about $\frac{3}{8}$ in. thick, and one, two or three sections are mounted to make one wheel. Cup brushes are specified by diameter and gage of wire. The general tendency is to seek wire brushes with heavy cross-sections of wire, but in practice the lighter gages will hold up better and do more work.

Correct Operating Speeds

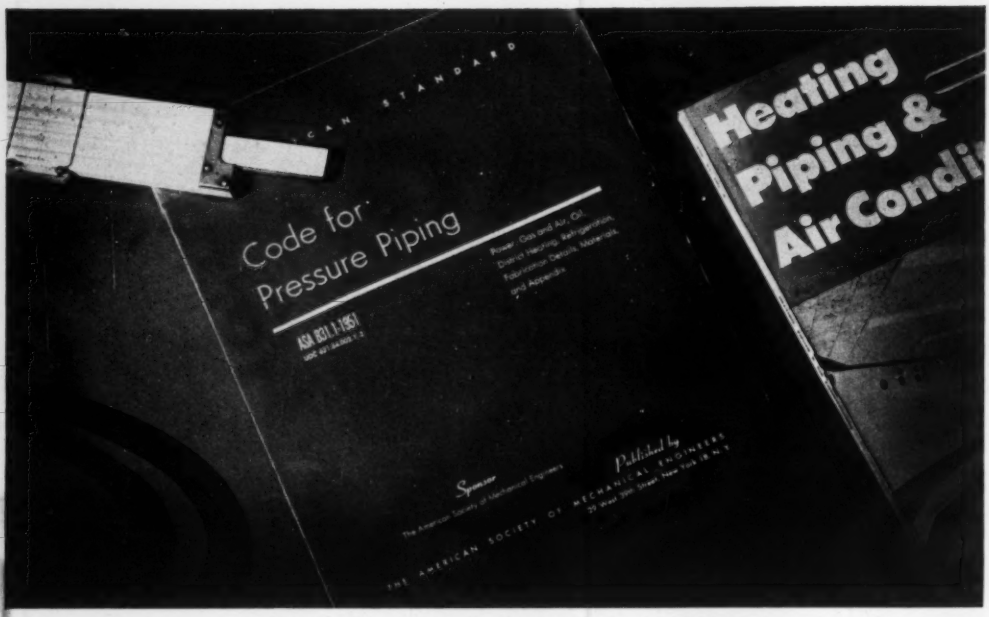
For rapid grinding, maintenance of high rotative speed under load is essential. Hand-held portable pneumatic grinders uniquely meet this condition because they develop the high power required with a minimum of weight.

A great number of accessories available for use with pneumatic drills and reamers, including such items as right angle attachments, tapping or stud setting attachments, etc., are of value in reducing operation time and speeding up production.

(In the April HPAC, Mr. Powers explained how to check the performance of industrial plant air compressing equipment, the distribution system, and the air powered tools and equipment to assure maximum productive efficiency.)

Specifications for sand rammers

Piston stroke, in.	Piston diameter, in.	Length, in.	Butt diameter, in.	Weight, lb	Hose, in.	Work adapted for
2	1	15	2	7	½	Bench work
4	1	20½	2½	12½	½	Bench work
5	1¼	49	3	21½	½	Floor work
6	1½	49	5¼	31	½	Heavy floor work and backfill tamper



The new code is an important "tool" for the engineer and contractor

Code for Pressure Piping

New 1951 Edition Just Published

The most important code covering piping is the American Standard Code for Pressure Piping, sponsored by the American Society of Mechanical Engineers under the procedures of the American Standards Association. Originally issued in 1935, a second edition appeared in 1942. The new 1951 edition has just been published, and this article reviews the changes that have been made. A coordinating committee has been set up to keep users of the code informed regularly of new data and to supply interpretations of code requirements

NEWSPAPERS REPORTED last month that property owners in an eastern state were protesting the installation of pipe lines carrying natural gas to nearby communities. Their protests were attributed largely to the fear that the pressures under which gas is run through the piping might prove dangerous.

Whether or not they were justified in their complaints, this type of hazard is only one of the problems taken into consideration in the American Standard Code for Pressure Piping.

The 1951 edition, just published, was prepared by a widely representative committee, sponsored by the American Society of Mechanical Engineers under the procedures of the American Standards Association. It is a standard of minimum safety requirements for the various piping systems that carry liquids or gases at high pressures — from the relatively tiny piping systems that operate deli-

Preparation of this article was made possible through the cooperation and assistance of officers and members of the Sectional Committee on Code for Pressure Piping, ASA B31, particularly F. S. G. Williams, chairman; Sabin Crocker, vice chairman; L. W. Benoit, secretary; H. D. Hancock; and A. C. Buensod.

cate instruments to the huge pipe lines that carry oil or gas for thousands of miles across the country.

It is intended as a guide in selecting materials that will safely withstand the pressures and temperatures under which the various piping systems are operated; in designating dimensions; in design and erection; and in testing the elements that make up a piping system as well as the completed system itself.

Since the first edition of the code in 1935, piping practice has changed considerably. New materials and new alloys make it possible to use higher temperatures and pressures than had been possible before.

New Materials for Power Piping

Twenty years ago, piping carrying steam for power was designed for pressures of from 200 to 600 lb and steam temperatures not in excess of 750 F; as recently as 1942, the highest commercial temperature was 925 F. Today, many large power piping systems are designed to carry steam at 1500 to 2000 lb pressure and 1000 to 1100 F temperature.

The 1951 edition takes cognizance of these changes by including references to recent editions of standards developed by the American Society for Testing Materials for new types of materials and alloys.

Changes in Section 1, on power piping, for example, have been made to include ASTM specifications for materials developed for high temperature service since 1942. These include seamless 1 percent chromium 0.5 percent molybdenum alloy steel pipe, ASTM A 315; pipe similar to Grade T-21 and T-22 alloy steel superheater tubes. New specifications included for other purposes are: heat treated carbon steel bolting material, ASTM A 261; Grade B steel machine bolts, nuts, and tap bolts, ASTM A 307 (a new specification similar to MSS SP-39); copper and copper alloy seamless tubes and ferrule stock, ASTM B 111.

Since a power piping system necessarily operates under widely different service conditions than those obtaining in a refrigeration piping system, for example, each section of the code provides special requirements for the materials to be used. Each type of piping system may be operated at any service pressure or temperature up to and including the maximum limits specified for the materials used. It is especially provided, however, that materials or products may be used at lower temperatures with pressures higher than their primary service ratings if an approved table of adjusted pressure-temperature ratings is provided in the standard governing that material or product. Definite limiting pressures and temperatures are given whenever a material or product would be hazardous if used at higher pressures or temperatures.

The possibility that new materials as satisfactory as those now being used may be developed or that conditions may require the use of different materials has not been overlooked. If such a situation should arise, the user of the piping system has been safeguarded in the following provision: "Should it be desired to use any materials or methods of manufacture not now covered by this code or which may be developed in the future, it is intended that the manufacturer shall provide details of design and construction which will be as safe as otherwise provided by the rules in the code. Where it is desired to use materials not included in Table 1, written application should be made to the committee fully describing the proposed material and the contemplated use, requesting that an allowable stress (*S* value) be assigned."

MEMBERS OF CODE COMMITTEE

Officers responsible for the work of Sectional Committee B31 on the Code for Pressure Piping, and chairmen of the subcommittees that prepared the individual sections of the code are:

F. S. G. Williams, Manager, Engineering-Standards, Taylor Forge and Pipe Works, *Chairman.*

Sabin Crocker, Mechanical Engineer, Ebasco Services, Inc., *Vice Chairman.*

L. W. Benoit, General Secretary, Manufacturers Standardization Society of the Valve and Fittings Industry, *Secretary.*

Subcommittee 1 on Power Piping — E. J. Wiseman, Mechanical Engineer, Stone and Webster Engineering Corp.

Subcommittee 2 on Gas and Air Piping — H. D. Hancock, President, Gas Advisers, Inc.

Subcommittee 3 on Oil Piping — R. D. Lepley, Engineer in Charge of Technical Div., Atlantic Refining Co.

Subcommittee 4 on District Heating Piping Systems — G. D. Winans, Assistant Superintendent of Central Heating, The Detroit Edison Co.

Subcommittee 5 on Refrigerating Piping — A. C. Buensod, President, Buensod-Stacey, Inc.

Subcommittee 6 on Fabrication — G. Sinding-Larsen, Vice President, Pittsburgh Piping and Equipment Co.

Subcommittee 7 on Coordination (Editing and Interpretations) — H. A. Wagner, Chief Mechanical Engineer, Engineering Dept., The Detroit Edison Co.

Subcommittee 8 on Materials and Stresses — J. J. Kanter, Materials Research Engineer, Crane Co.

Subcommittee 9 on Standards and Identification — L. W. Kattelle, Assistant Chief Engineer, Walworth Co.

Subcommittee 10 on Instrument Piping — R. E. Sprenkle, Hydraulic Engineer, Bailey Meter Co.

Subcommittee 11 on Liaison with Other Codes and Standards — C. A. Kelting, Assistant Division Engineer, Consolidated Edison Co. of New York.

Copies of the American Standard Code for Pressure Piping, B31.1-1951, are available at $3.50 from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Fabricating Systems and Components

In addition to minimum requirements for the different types of piping systems — power, gas and air, oil, district heating, refrigeration — comprehensive requirements are included for fabrication of piping components and systems. Minimum requirements also are provided for the construction of pipe hangers and anchors for these systems. They outline approved methods of providing for the thermal expansion of piping and for the flexibility of piping systems. They tell how parts should be prepared for welding, and how welded pipe joints should be made and tested, and they tell how to test welding processes and operations. They also tell how to fabricate and weld branch connections, and how to fabricate pipe joints other than welded joints.

Since welding procedures and the qualification of operators for welding pipe joints are in accordance with the ASME Boiler Code, a copy of section IX of that code is enclosed as an insert inside the back cover of each copy of the Code for Pressure Piping.

Minimum safety standards for all the component parts of piping systems carrying steam, water, and oil, as well as for the system itself, are outlined. These parts include the pipe, flanges, bolting, gaskets, valves and fittings.

The ASME Code for Power Boilers governs piping coming under Boiler Code jurisdiction wherever the Boiler Code requirements exceed corresponding requirements of the Pressure Piping Code. Specifications for materials listed in Table 1 have been brought up to date by the addition of those completed since 1942. The maximum limiting temperature at which these materials may be used for power piping has been raised from 1000 to 1100 F. Values for

allowable stresses (*S* values) as shown in the ASME Boiler Code have been added for materials used at 1050 F and 1100 F.

Graphitization of Welded Joints

A warning is sounded against the danger of graphitization of welded joints through prolonged exposure to higher temperatures than are suitable to the particular material. Experience has shown that severe shock in a piping system may pull a welded joint apart if extensive graphitization has taken place. The piping code cautions, therefore, that where welded construction is used, graphitization may occur if carbon steel should be subjected over a long period of time to temperatures in excess of 775 F; carbon-molybdenum steel to temperatures in excess of 875 F; and chromium-molybdenum steel, with chromium under 0.60 percent, to temperatures in excess of 975 F.

Before erection, steel fittings and valves must be capable of withstanding the hydrostatic test pressures given in supplement No. 1 to the American Standard for Steel Pipe Flanges and Flanged Fittings (B16e).

To assure safety, a hydrostatic test is to be applied after erection wherever practicable.

Gas and Air Piping

In 1942, when the edition preceding the 1951 edition of the Code for Pressure Piping was published, the largest heavy-duty cross country gas pipe lines were 20 to 24 in. in diameter and were operated at pressures usually in the range of 700 to 900 psi or less. Since that time the Federal Power Commission has issued certificates for nearly 34,000 miles of transmission lines including the new long distance lines extending from southwestern producing fields to eastern consuming areas.

Several of the recently installed heavy duty lines are 30 in. in diameter, and a 34 in. diameter line is now under construction. Steady improvement in materials has made it possible to increase the unit working stresses in pipe walls, thus permitting increase in pipe diameter for a given wall thickness without a corresponding decrease in gas pressures. Not only is the greatly enlarged volume of gas transported an economically significant item, but it is estimated that the more efficient use of steel makes it possible to save as much as 100,000 tons on one cross country pipe line alone.

The Code for Pressure Piping has played an important role in the extension of gas as an economical fuel to large population centers. An experience in one state in 1949 offers an example. Country property owners protested the installation of a gas pipe line on the ground that it would be unsafe. An investigation by the state public utility commission put the pipe through severe tests, and proved to the satisfaction of the commission that pipe meeting the requirements of the code would be safe. This commission is only one of the regulatory groups that have ordered that gas pipe lines follow the requirements of the Code for Pressure Piping.

Honor the "Defenders of Freedom"

Display the Flag on Armed Forces Day May 19

According to representatives of subcommittee 2, which is responsible for this section, the gas industry is interested in the code because it provides realistic minimum construction requirements and offers the basis for a program of self-regulation in matters of safety.

The minimum safety requirements outlined in this section not only apply to cross country gas transportation systems but to distribution systems in cities, and to gas and air piping in compressing stations, mines, and in power, industrial and gas manufacturing plants. These piping systems are classified in two divisions. Division 1 covers gas distribution and certain other gas and air piping systems, and division 2 covers cross country transportation systems, this division including compressing stations.

Development of new specifications for materials has been recognized by eliminating some of those formerly in effect and substituting new ASTM and American Petroleum Institute specifications now in general use.

Important changes have been made in provisions relating to the joint efficiency of the mill welds in the various classes of welded pipe.

New requirements have been included for pipe (except cast iron pipe) in gas and air compressing station piping systems. These will result in somewhat thicker pipe walls, other factors being equal, than previously required for compressing station piping.

Oil Piping Systems

The huge pipe lines carrying oil from refinery to market, as well as piping used in refineries, in blending and compounding plants, terminals and gas processing plants are covered in the oil piping section. These minimum safety requirements and recommended practices apply to component parts but not to crude oil gathering systems in oil fields unless they are in developed residential, business or industrial areas of cities or villages. Pipe and tubing used in gas or oil wells or in the tanks and lines used in production of crude oil are not included.

Because an accident in a crowded city or factory offers an entirely different degree of hazard from one in an open field, the piping systems covered by this section have been classified into two divisions. Division A includes all oil piping systems other than oil transmission lines outside of cities and villages, which are included in division B.

All requirements of the code apply to both divisions unless specifically stated. For example, more elaborate testing requirements are involved in division A piping than in division B.

The modified Lamé formula, used in other sections of the code, is now being used in this section as the primary basis formula for determining wall thickness of pipe.

Tables of pressure-temperature ratings have been revised to bring them in line with new pressure-temperature ratings in the 1949 supplement to the standard for Steel Pipe Flanges and Flanged Fittings, B16e - 1939.

Allowable stresses have been added in tables for new types of pipe.

One important change has been made to prevent possible accidents through restrictions in the use of block valves. Block valves may now be used for inspection and test of relief valves only as permitted by the API-ASME Code for Unfired

Pressure Vessels or the ASME Unfired Pressure Vessel Code.

Refrigeration Piping Use Increases

In the decade from 1940 to 1950, manufacturers' shipments of refrigeration and air conditioning equipment increased tremendously. At the same time, a number of new refrigerants came into use.

This widely increased use of refrigeration and air conditioning, for preserving food, for comfort in office buildings, for control of temperatures in laboratories, in precise manufacturing processes, etc., emphasized the importance of bringing up-to-date the minimum requirements for refrigeration piping in the new edition of the Code for Pressure Piping.

The refrigeration section of the code covers the design, manufacture and installation of piping systems and component parts, including flanges, bolting, gaskets, valves and fittings for refrigerants and brines. Testing and safety precautions for the use of refrigerating systems are covered in the American Standard Safety Code for Mechanical Refrigeration, B9.1-1950.

Minimum design pressures for refrigerant piping with all the presently known refrigerants listed are contained in the refrigeration section of the piping code. For refrigerants not listed, provision is made for calculating the minimum pressures suitable for the refrigerant to be used.

The code contains all the approved standard materials specifications, as well as a table covering stress values for use in pipe and tubing.

A formula is provided for figuring the pipe wall thickness using the stress values as given in the table for the material to be used, all subject to the specific minimum thickness requirements stated in the code. This is in conformity with the same provisions contained in the American Standard Safety Code for Mechanical Refrigeration, B9.1-1950.

No Important Changes in District Heating Piping

The district heating piping section provides minimum safety recommendations for design, manufacture, test and installation of district heating and central heating piping systems and component parts. These systems are used for the distribution of steam or hot water, for pressures not exceeding 600 psi or temperatures not above 750 F. No important changes have been made.

Instrument and Control Piping

It is just as important that piping connecting the main pipe lines with instruments, such as pressure gages and flow meters, meet approved minimum requirements as that the main piping itself meets such requirements. To assure that instrument piping will come up to the same standards, requirements for instrument piping are included in each of the main sections of the code.

Since there are no general standards for the tube fittings used with instrument piping, an appendix describes the various types of fittings permitted for use with instrument and control piping. Of particular importance are designs illustrating flared and flareless fittings. For high pressure service, the flared fittings are in accord with Army-Navy Design 10061; for medium pressure service, they are in accord with SAE specifications.

A chart makes it easy to select tubing and fittings for any given set of conditions by tabulating the material and type of fittings suitable for different temperatures and pressures.

Coordinating Committee To Interpret Code

An unusual feature of the new code is the service that has been set up to keep users informed of new data as they become available. A coordinating committee, under the chairmanship of Harvey A. Wagner, of The Detroit Edison Co., has been formed to answer questions of interpretation and to keep track of new materials specifications. Throughout the code, materials standards, tests and specifications are referred to in general, without reference to any specific edition. Appendix 2 lists the editions of these standards in effect at the time the code went to press. It will be the responsibility of the coordinating committee to keep track of new editions, and to issue a corrected list of current editions periodically, after approval by the committee.

When new materials come on the market, the coordinating committee will issue an analysis of the stress values and temperatures at which the material can be used under the code.

This service will be available on a subscription basis. Details can be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y., which is sponsor for the code.

Membership of the coordinating committee consists primarily of the chairman of each of the piping subsections of Sectional Committee B31.

After the solution to a question has been found by the coordinating committee or its opinion has been given, it will be submitted to the executive committee of Sectional Committee B31, and published by the ASME as a public notice. It will be put through the regular procedure of the American Standards Association to become a permanent part of the code.

[This article is also being published in the May issue of Standardization, journal of the American Standards Association, whose cooperation is gratefully acknowledged.]

"QUOTE"

"An important milestone in the history of the American steel industry was reached during 1950. The industry's annual ingot capacity passed the 100 million ton mark and from time to time during the year the industry produced at an annual rate of more than 100 million tons.

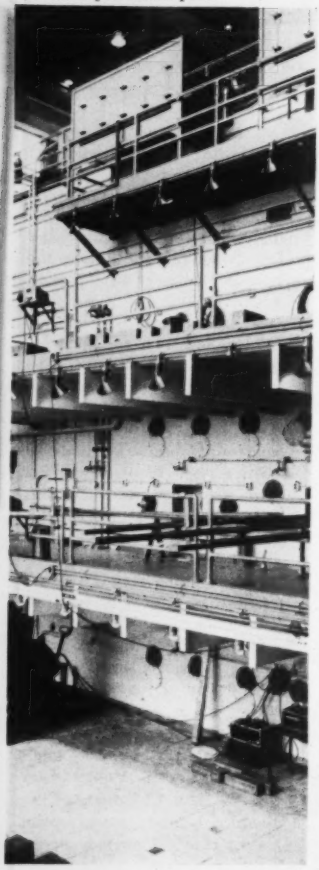
"The fact that the steel industry has reached and passed the 100 million ingot ton mark can be of deep satisfaction to the American people in these uncertain times. One hundred million tons of steel is 47.2 million tons or nearly 90 percent more than was produced by the American steel industry in 1939 when World War II was starting. It is about 12 percent more than the peak wartime production of this country in 1944. It is approximately equal to the estimated steel capacity of the rest of the world combined. It is more than three times the estimated steel production of Russia and its satellite countries in 1950."—Irving S. Olds, Chairman of the Board, United States Steel Corp., in 1950 annual report.

Extensive Cooling Needed for New Nuclear Reactor

THE NEW ATOMIC reactor at Brookhaven National Laboratory, Upton, N.Y., which was built exclusively for research, is a giant cube of graphite into which uranium metal is inserted in an exact pattern. Its primary purpose is to produce neutrons for scientific experimentation. Extensive cooling facilities are necessary to the operation of such a reactor.

A pile in operation becomes a vast reservoir of neutrons and a source of fission products, the radioactive substances into which the uranium nuclei are split. The dense population of neutrons inside the reactor gives ample opportunity to gain further knowledge of the neutrons themselves and of substances exposed to them. The neutrons will be utilized by inserting materials into the reactor, or by allowing beams of neutrons to emerge under controlled conditions through holes in the shield surrounding the reactor.

FACE OF ATOMIC REACTOR has three levels for carrying on experiments. Materials studied are inserted in the experimental ports



Most chemical elements, when inserted in the reactor and bombarded by neutrons, emerge radioactive. Known as radioisotopes, they are used by physicists and chemists to study the fundamental nature of matter. Many radioisotopes decay by emission of rays or particles in short times (minutes, seconds or less) and thus require study close to the reactor. For this reason, Brookhaven's reactor has pneumatic tubes which whisk samples to be studied into the reactor and out to adjacent laboratories in a few seconds. Other radioisotopes which exist for longer periods will also be studied. Radioisotopes, especially in this latter group, serve as important research tools in biology, medicine, agriculture and engineering. Other types of experiments make use of the neutrons within the pile, or beams of neutrons emerging through openings in the shield wall.

The cube of graphite where the atomic reaction actually takes place is composed of 60,000 pieces of graphite stacked one atop another like building blocks. There are 2600 different sizes and shapes of graphite, and an individual drawing was prepared for each of the 2600 variations.

There is no bonding material between the individual blocks of graphite, and a highly complicated keying system, in which every piece is keyed either once or twice, is part of the design. The lack of a bonding agent, which would have made the process unworkable, accounts in part for the close tolerances required to hold the structure together. Both external and internal forces also had to be compensated for in the design of graphite. External forces are strong due to the pressure drop required to provide the large volume of air used to cool the pile. Internal forces arise from the temperature differentials inside the graphite cube during the atomic reaction.

To remove the 30,000 kw of heat generated within the pile during the fission process, an extensive cooling system is required. In the fan house adjacent to the reactor building, centrifugal compressors draw 300,000 cfm of air through the pile cooling system. Air speeds vary from 40 mph in the main ducts, two of which are large enough to accommodate a New York subway train, to hundreds of mph in the small graphite passageways. Each of the five blowers is driven by a 1500 hp motor at 3600 rpm.

Air is filtered before and after it leaves the pile. Dust is taken out before air goes into the pile, and any dust which may have been picked up inside the pile is removed before it is expelled. The air is finally exhausted through a 320 ft reinforced concrete stack tapering from 32 ft diameter at the base to 19 ft at the top. A silencer of unique design was built into the ducts and the base of the stack to eliminate noise which would be disturbing.

A secondary cooling system is necessary because temperatures of exhaust gases from the pile are higher than temperatures concrete can stand continuously. The secondary cooling system prevents impairment of the strength and the life of the concrete in the duct system.

Five hundred tons of refrigeration is required for air conditioning the pile building control areas, the pile laboratory and an adjacent "hot" laboratory where radioactive materials are handled. Low humidity is essential in these buildings for process control of ambient conditions. Air conditioning is installed only in laboratory working areas which require maintenance of uniform temperature and humidity conditions for operation of delicate instruments and control of experiments.

[Engineering design and construction of the Brookhaven reactor were carried out by The H. K. Ferguson Co. under supervision of Wells N. Thompson, vice president.]

Ventilation of Survival Areas for Civil Defense

By Howard C. Murphy

Mr. Murphy, consulting engineer and member of HPAC's board of consulting and contributing editors, has had a great deal of experience in air filtering and air conditioning. He explains here that it is not necessary to introduce outside air to protective shelters, but that it is safer and much less complicated to make the structure airtight. He stresses also the necessity of protecting air handling equipment having access to outdoors against the air blast and shock wave, possibly by some sort of baffle arrangement as indicated in his sketch

CIVIL DEFENSE is not a popular or pleasant subject. We blow hot when threat of aggression seems imminent and cold when news is better. Realizing the potentialities of atomic warfare, the human mind seeks every opportunity to turn to other thoughts.

Nevertheless, whether we like it or not, the atomic age is here, and we must live with it.

It is possible to design structures which will protect men and material from even a direct hit by an atom bomb. Except for control, communication and vital service areas, however, such construction would probably be too expensive for general use. It might require the equivalent of a completely air conditioned windowless structure of very thick reinforced concrete, equipped with independent power and water supplies as well as many other planned-in-advance features.

Studies made by the Atomic Energy Commission and the Department of Defense indicate, however, that new construction and in many cases certain areas of existing structures, half a mile or more from a probable target, can at reasonable expense be made comparatively safe against an atomic explosion. Obviously there is a certain risk that the bomb might explode closer and, of course, the alternative is to provide more extensive protection [Damage from Atomic Explosion and Design of Protective Structures, U.S. Govt. Printing Office.]

The architect, engineer and city planner have many problems facing them in this work. There is much information available on the subject, but a consideration of structural design, dispersal, underground construction, etc. are beyond the scope of this article, which is limited to a discussion of methods of ventilating survival areas, with special attention to procedures for eliminating airborne radioactive or biological poisons.

SIMPLE DAMPER OR LABYRINTH suggested by the author for possible protection of building ventilating system from damage by shock wave

Since high level explosions have been found to be most destructive, we would normally expect such an attack rather than an explosion at the surface of the earth or under water. The upward currents caused by such an explosion in the air should, except under unusual meteorological conditions, carry most of the radioactive dust and residual material high into the air. Consequently, after the first 90 sec there should be little danger from radioactive dust in a high level explosion. The alpha and beta particles are completely absorbed by the air before reaching the earth, and the gamma radiation is the principal concern in this type of explosion.

While radioactivity caused 15 percent of the deaths in the Japanese bombings, all of the absorption occurred within the first few seconds; no deaths could be attributed to "lingering" radioactivity.

However, in the case of an explosion at ground level, or in the event that a bomb is detonated under water, or if additional radiological or biological warfare weapons are used, radioactive particles or pathogenic organisms might be airborne for considerable distance and persist for some time.

The Civil Defense Administration expresses the opinion [Health Services and Special Weapons Defense, Federal Civil Defense Administration, U.S. Government Printing Office] that we must seriously consider the possibility of attack by gas and

by airborne bacteria as well as by atomic weapons. Its report recommends that large shelters and auditoriums or similar structures should be protected by filters. It would seem desirable to design refuge areas so that protection could be offered against all airborne poisons such as radioactive dusts, gamma radiation, pathogenic organisms, nerve gases, etc.

As community shelters, shelter areas in manufacturing plants, office buildings and places of public assemblage are planned to be airtight against outside air, all doors or other outlets to the outside air should be blast-resistant, of wood or steel at least 8½ in. thick for shielding against gamma rays, and should be designed to withstand a pressure of 500 lb per sq ft.

Some manual method of recirculating the air within the shelter is desirable and consideration should be given to self-contained water and drainage facilities, as well as the provision of battery lights, chemical toilets and telephone connections with the outside. It would also be desirable to provide a portable instrument for measuring radioactivity.

Vitiation of the Air

The question is sometimes raised as to whether the decrease in the oxygen content of the air, the increase of CO_2 or other vitiating factors in a tightly closed area occupied by a number of people would present a problem.

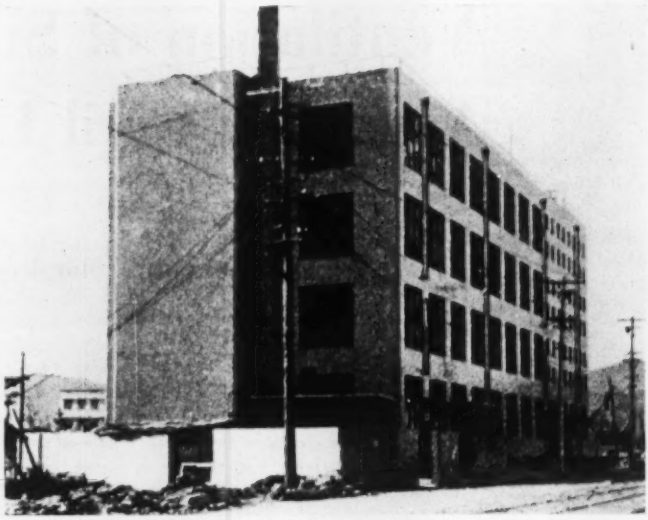
In the operation of a submerged submarine, the U.S. Navy considers air containing less than 12 percent oxygen or more than 5 percent CO_2 dangerous.

The Navy formula for determining the length of time required for the CO_2 concentration to reach 3 percent is

$$T = 0.04\ V/N$$

where T = time in hours to reach a 3 percent concentration of CO_2; V = Net air space of ship, cu ft; N = Number of persons on board.

If the net air space is 35,000 cu ft and the number of persons is 80, by substituting these values in the formula we arrive at 17½ hr as the time required to reach a 3 percent concentration of CO_2. In the same interval, the oxygen content of the air will have been reduced from a normal of 21 percent to 17 percent.



JAPANESE BUILDING, 5300 ft from "ground zero", of reinforced concrete frame construction, had interior practically undamaged except for windows

The Navy procedures for maintaining normal balance of oxygen and CO_2 in submarines are described in Chapt. 38, Bureau of Ships Manual [U. S. Government Printing Office].

In view of the fact that it will probably not be necessary to occupy air raid shelters or survival areas for more than a few hours at a time, it would appear from the above that it is unnecessary to introduce outside air.

Existing Buildings Adaptable

It is possible that many existing windowless factories and office buildings could, with some additional planning, provide adequate protection in atomic or biological warfare.

Such buildings are usually equipped with complete ventilating and air conditioning systems and arrangements can be made for 100 percent recirculation of the air. All air inlet and outlet connections to the outside air should have suitably designed baffles to protect the system against the shock wave and thermal radiation. The blast effect, thermal and initial nuclear radiation are applied with supersonic velocities, but persist for only a matter of seconds. The shock wave and the accompanying air blast travelling at a velocity slightly higher than sound has many of the characteristics of a moving wall of highly compressed air or water. It seems possible, therefore that the provision of a baffle or labyrinth at the air inlet and outlet openings in the outside walls of the building would prevent damage to the ventilating system and at the same time allow the inlets and outlets to function without undue resistance to air flow when handling air at the velocities normally used in the ventilating system.

It may be that even a simple damper construction, as suggested diagrammatically herewith, would be adequate for the purpose. In coast artillery emplacements and in the Maginot line, baffled openings show some effect in eliminating blast and sound. More efficient constructions on the order of the Maxim silencer or the muffler of an automobile will suggest themselves to the designer.

A number of studies on the action of shock waves have been reported in connection with wind tunnels. Bleakney and others have discussed this subject [Review of Scientific Instruments, Vol. 20, No. 11, November 1949] and considerable data were developed at Princeton University for the U.S. Navy [Diffraction of Shock Waves, TIP U-11073 and TIP U-11266, Navy Research Section, Science Division, Library of Congress, Washington, D.C.]. Much valuable information on shock wave and air blast damage is also available in AEC publications [The Effect of

Atomic Weapons, U.S. Government Printing Office].

In addition to windowless buildings, it is possible that many existing structures of usual design not too close to target areas could be adapted to provide a high degree of safety against atomic, gas and bacterial warfare.

In Japan no building having earthquake resistant design was materially damaged at a distance of 2000 ft. In 11 of our western states, building codes require earthquake resistant design for certain classes of buildings. The Pacific Coast area has the highest requirements and would therefore probably have a higher resistance to damage by bombing. In one four-story, reinforced concrete frame building in Japan 5300 ft from the center of the explosion, the interior was practically undamaged, except for the window glass. The reinforced concrete ventilating ducts and much of the equipment were not seriously damaged.

The protection of interiors and of essential equipment will require study of each individual case. There are, however, considerable data available.

Effectiveness of Air Cleaners

In view of the rapid increase in the production of radioactive materials by government agencies and private industry, I believe some consideration of the effectiveness of various types of air cleaners in removing radioactive particles and other products of nuclear fission from an air stream and some specific problems in their operation might be discussed here.

The problem is a difficult one, calling for the removal from an air stream of extremely small radioactive particles and other products of the fission process.

At present, despite best efforts, some of the atomic energy plants may under certain conditions be discharging radioactive material from their stacks, setting up health hazards in adjacent areas which, at this time, no one can accurately evaluate. The air in the vicinity of these plants is constantly monitored and, if unduly high concentrations are noted, steps are taken to reduce the contamination.

At one laboratory, only a short distance from a big metropolitan area, the air for processing is filtered before and after use and then dispersed to the atmosphere at high velocities through stacks over 300 ft tall. When the wind is from the wrong direction, or other unsuitable atmospheric conditions are encountered, certain operations are shut down.

The Atomic Energy Commission has established a limit of 10 microcuries per cubic centimeter of air for beta and gamma activity. The hazard from alpha activity is greater and the general limit for alpha activity corresponds to two disintegrations per minute per liter of beta and gamma activity.

When air is used to cool nuclear reactors, radioactive argon isotopes with half-lives varying from 110 min to 34 days are produced. In the fission of uranium 235, ten isotopes of iodine are produced with half-lives varying from 2.6 sec to 10^8 yr. This is one of the more hazardous radioactive isotopes because of its effect on the metabolism of the body.

Mildly radioactive plutonium, however, may present a very real hazard in the respiratory system or in any other part of the body as the slightest trace is dangerous. It has been established that water containing one part of plutonium in one trillion is dangerous as the material gradually accumulates in certain parts of the body, destroying surrounding tissue.

Many sleepless nights have been spent in a search for the safest method of disposing of radioactive wastes — gaseous, liquid and solid.

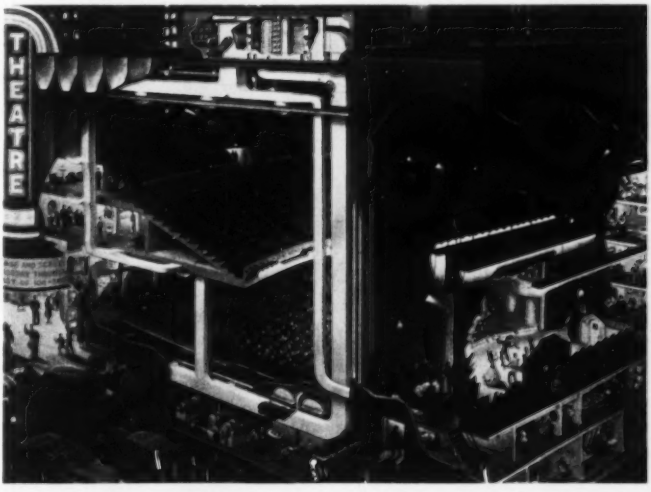
The Atomic Energy Commission has recently declassified information developed in studies made with certain types of mechanical air cleaners. This report will be considered in a second article.

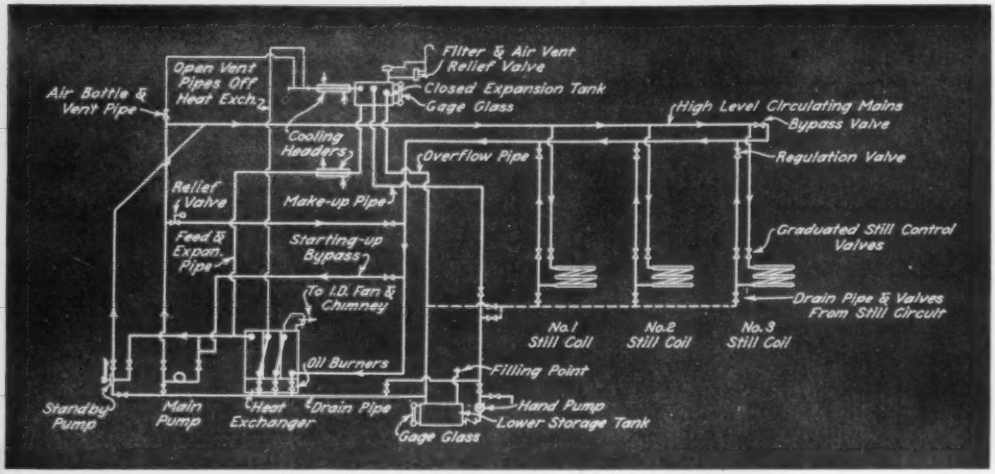
Other studies are under way by various agencies and reports of their findings should be generally available shortly.

EXPLAINS HOW THEATER IS AIR CONDITIONED

Operating a modern, successful theater is not all showmanship. Theater managers and owners know that a successful house must provide comfortable and pleasant surroundings for the audience. Many of the highly important theater activities necessary for audience comfort and satisfaction are carried on behind the scenes.

In a full-color advertisement, in The Saturday Evening Post, the Armstrong Cork Co. has attempted to explain briefly to the public how a modern theater is air conditioned for both summer and winter comfort. By means of a cutaway view of a big theater and accompanying explanation, the advertisement tells of the facilities necessary to provide air conditioning. The copy stresses the importance of insulation to prevent waste and allow satisfactory performance.





CIRCULATION IS SIMILAR to forced hot water system, but there are a number of piping modifications due to the necessity of moisture exclusion and the provision of a large storage tank

High Temperature Liquid Process Piping Systems

By W. F. Moore

Described in this article from England is a new installation utilizing tetra cresyl silicate as the heating medium

ENGINEERS HAVE long recognized that there are inherent disadvantages in using steam to obtain the high temperatures essential for many industrial processes. The development and successful application of high temperature hot water systems is one outcome of the search for new methods. But it cannot be said that such systems fulfill all the requirements. A high pressure is still necessary to obtain relatively low operating temperatures and precautions have to be taken to prevent water from flashing off into steam. The search for new heat transfer media has gone on and many new and promising materials have been tried.

The properties of water as they affect heat transfer are so suitable and so well known that they have come to be taken for granted. Before new liquids may safely be used, their chemical and physical properties must be scrutinized carefully.

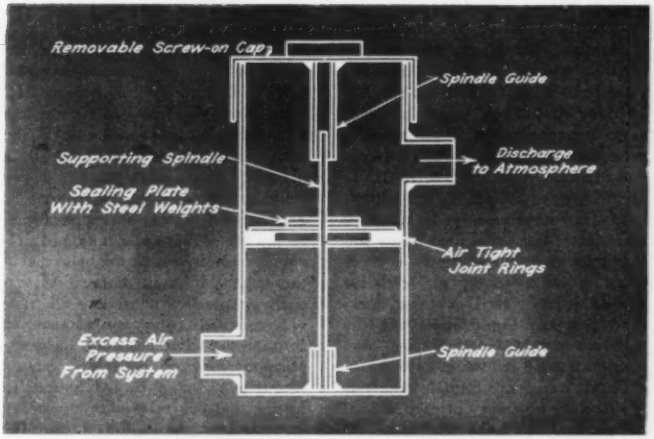
Liquid heat transfer media must not corrode the piping materials commonly available, the fire risk must be small and those with strong odors may be objectionable. Stability over the operating temperature range is essential, but it is desirable also that there should be a margin of safe operating temperature to allow for local overheating which occurs at the heat exchange surfaces. (Some liquids which meet these requirements must be ruled out because their characteristics alter over a short period of time due to the cyclic thermal changes occurring in the normal process heat transfer system). The liquids must be easy to handle and there should be no risk to personnel.

In general, an ideal heat transfer

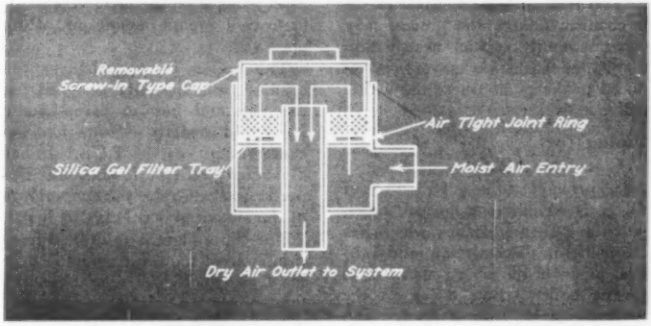
liquid should have a high boiling point, a low freezing point, a high thermal conductivity and a low viscosity throughout the operating temperature range. A high heat capacity is desirable, in most cases, to reduce the total quantity of liquid to be stored and circulated, although for some applications a low heat capacity is preferable in order to give, by more rapid circulation, a higher rate of heat interchange and a lower heat inertia.

Tetra aryl silicates form a group of organic substances having high boiling and low melting points. Liquids of a common generic type have been produced having different physical properties and with definite boiling and freezing points within a liquid range of minus 60 F to plus 800 F. These and other substances have been used as heat transfer liquids for the heating of molds and coating rolls; for the melting of fats, minerals and alloys; for evaporating liquids at high temperatures; for distilling inflammable liquids; for drying and enamelling ovens; for galley cooking equipment; and for the heating of jacketed pipe lines and pump casings for conveying liquids which do not flow at normal temperatures.

One of the most recently developed materials in the tetra aryl silicate group is tetra cresyl silicate. The first major installation employing this medium in England, apart from small experimental plants, was recently described by R. A. Rose, of J. T. Meredith & Co. Ltd., London, in a paper on heating by means of tetra cresyl silicate published in the Journal of the Institution of Heating and Ventilating Engineers, Vol. 18, No. 186, p. 408.



AIR VENT RELIEF VALVE used on the closed expansion tank. Moisture in system would result in increased viscosity of circulated liquid



MOISTURE ABSORPTION TRAP, specially designed, employs silica gel, is fitted to the expansion pipe

Used in Production of Gin

The application is to gin production in a London distillery. Prior to 1939, gin produced for consumption in England was made from maize. During the war, an alternative raw material was found in molasses spirit. Consumers apparently now prefer this type of gin and it seems unlikely that distillers will revert to the original method.

Molasses spirit, from Mauritius and the West Indies, is the uncrystallizable portion of the sugar; the scum which forms on top of the sugar boilers. It contains up to 55 percent of sugar or sucrose. After treatment with acid, it is fermented with yeast for periods of up to a week and the resulting solution is distilled in a rectifying still to produce raw spirit at 66 percent proof, which is the actual liquor imported into England.

After preliminary treatment, the raw spirit is placed in a rectifying still to produce the pure spirit which is the basis of the gin. Various herbs are added in a gin still and, after further distillation, a gin with the characteristic flavor associated with a particular distillery is obtained. The flavor matures after a short period in wooden casks.

In this particular London distillery, there are three stills — a 50 year old rectifying still of 1700 gal capacity and two gin stills of 800 and 400 gal, both of which have been operated for over 150 years.

The stills were formerly heated by hand-fired coal furnaces directly below the stills. The plant requires operating temperatures of 300 to 400 F, which were controlled solely by the skill of the operators with knowledge handed down from father to son.

Liquid Is Like Heavy Fuel Oil

Heat transfer surface for the stills is now in the form of solid drawn heavy gage copper tube coils, through which tetra cresyl silicate is circulated by pump. The liquid can be handled throughout its temperature range by circulators suitable for high pressure hot water, with but slight gland modifications.

In its refined state, tetra cresyl silicate (T.C.S.) is like an ordinary lubricating oil but in the crude form as used on this installation it is comparable to a heavy fuel oil. It has an odor of phenol, which becomes more pronounced at high temperatures. The temperature range is considerable — from 1 F up to 825 F.

So far as is known, T.C.S. is inert toward all metals except light alloys and zinc. Compressed asbestos impregnated with graphite appears to be a suitable gasket material for flanged joints. It is expected, however, that the liquid itself will deteriorate over a period of years and result in some reduction of the rate of heat transfer. Sample analysis is therefore necessary at each annual maintenance period.

The pumps are duplicated and, in addition, there is a gas engine available so that, in spite of electrical or mechanical failure, the process may continue until residual heat within the boiler (heat exchanger) is reduced to the point where the T.C.S. will not overheat.

Piping for Circulating T.C.S.

In principle, the circulation of T.C.S. is similar to a normal forced hot water heating system which has the pump on the flow main and open vent pipes off the return mains close to the boiler. But, owing to the necessity of moisture exclusion and the provision of a large storage tank — the system contains 700 gal of T.C.S. — to hold the liquid when emptying down, there are a number of important circuit modifications.

Moisture in the system results in the formation of cresol and a consequent increase in the viscosity of the liquid. Pressure-testing is therefore done with air; a closed expansion tank with relief valve is used; and a specially-designed moisture absorption trap, employing silica gel, is fitted to the expansion pipe.

The feed and expansion pipe between the equipment and the expansion tank is always full of liquid. With expansion and contraction, the liquid moves into and out of the tank, which would quickly reach a high internal temperature unless something were done to prevent it. Exposure of high temperature T.C.S. to the atmosphere sets up rapid cresol hydrolysis, which might occur in the expansion tank since it is virtually impossible to remove all trace of moisture from air drawn in through the silica gel filter. The expansion pipe is therefore passed through a water cooled jacket to insure that, at maximum operating temperatures, the liquid reaching the expansion tank is cooled to approximately 100 F. A similar arrangement is made on the main vent header to cool vapors passing out of the open vents.

The boiler (heat exchanger) is oil-fired, was specially designed for this job and has an exceptionally low liquid capacity — important because of the cost of T.C.S. It has a nominal rating of 4,660,000 Btu per hr and will raise the temperature of the system to 350 F in 1¼ hr.

The entire plant is controlled from a high level platform mounted over the firing floor. All distant reading thermometers and altitude gages are grouped on a central control panel, flanked on either side by the associated electrical gear and motor starters.

Other Possibilities of Method

Tetra cresyl silicate is expensive, its present price automatically reserving it for processes requiring high temperatures of the order of 500 to 700 F.

Whether high temperature fluids will be used for comfort heating is problematical. A case may be argued for their use in high temperature radiant heat installations, but even so the first cost of the liquid is a significant fraction of the total initial cost.

In other directions, however, a wide field is opening to the more general employment of high boiling and low freezing point fluids. And not only in the process heating sphere. One of the virtues of high temperature fluids is that, with them, a heat engine can be operated at a higher efficiency than with water.

An atomic pile is at present cooled with air. If an atomic pile were used as a source of power, the cooling medium would need to be recirculated and a suitable high temperature fluid would have to be found. Liquid sodium has, in fact, been suggested for this purpose.

[Sketches reproduced by courtesy of the Institution of Heating and Ventilating Engineers.]

TETRA CRESYL SILICATE — principal physical data

Boiling point	435 - 440 C	
Specific gravity at 25 C	1.125 - 1.130	
200 "	0.982	
300 "	0.908	
Specific heat (cal/gm/C)		
at 25 "	0.40	
200 "	0.530	
300 "	0.620	
Viscosity at 25 C	41 centistokes	
200 C	1.4 "	
Coefficient of expansion	0 - 100 C	0.000775
	0 - 400 C	0.000977
Thermal conductivity (cslories/sec/sq cm/C)		
at 25 C	346 x 10^{-4}	
200 C	328 x 10^{-4}	
300 C	318 x 10^{-4}	
Density	1.106	
Flash point	325 F minimum	
Medium is fluid at	—20 C	

TO BUILD HOLLOW-JET VALVES

A CONTRACT to build three 84 in. inlet diameter hollow jet valves for a Kajakai, Afghanistan irrigation project has been awarded to the Sunnyvale, Calif., plant of the Westinghouse Electric Corp.

Hollow jet valves are used with dams that discharge water onto erodable soil, or to eliminate excessive spray and mist in the vicinity of delicate electrical machinery and equipment. About 10 ft long and 12 ft in outside diameter, they are usually shipped as integral units containing needle, surrounding concentric cylinder and outer shell.

Hollow jet, free discharge valves, mounted at the end of a penstock or conduit, provide control of discharge of water from reservoir to downstream channels.

Water is aerated as it goes through the valve, most of the air entering inside the nappe of the jet, with additional air entering through six hollow radial splitters around the cylinder circumference. The resulting "hollow jet" is filled with thousands of air bubbles trapped in the stream. This aeration cushions the force of water against the stilling bed, and acts as a cohesive agent to hold the water together to reduce misting.

QUESTION of the Month

QUESTIONS on heating, piping and air conditioning asked by HPAC's readers are answered here each month. We hope you will find these practical comments of regular interest, and will contribute either a question, or an answer to a published question, on occasion. Why not send in a question of your own, or answer the question on drying refrigerator cars, today? Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Illinois.

COMFORT AT THE OUTSIDE WALLS

THERE APPEARED some months ago in HPAC the following request for information from a consulting engineer in Montana:

"The question has arisen in this office several times as to the advisability of ceiling type radiant panels for buildings in this section of the country without providing a floor panel, where these buildings are situated on a compacted sand fill using a 4 in. concrete slab as the floor.

"From the heat loss calculation standpoint, under certain conditions sufficient panels can be provided in the ceilings without going to auxiliary panels in the walls or floor.

"However, the question comes to mind that trouble may develop along the outside walls of installations of this nature where conditions would be such in extreme weather that moisture and frosting would occur under extreme conditions of minus 30 deg even though a strip of 1 in. rigid insulation were provided between the footings and the floor around the outside perimeter of the building.

"We are writing with the thought that perhaps those who have had some experience with this type of installation might have comments and recommendations, which would be most welcome."

This question has several practical answers. Here is the reasoning which leads to a most interesting one.

Heat loss from a building results in cooling of unheated indoor surfaces of exposed areas. Indoor air in contact with these surfaces is consequently cooled.

At outside walls, and more especially at windows, there results a falling current of air at reduced temperature. The reduction in temperature will be proportional to the heat loss which the air has supplied by contact with the exposed area. This loss may well be as much as 70 percent of the total building loss.

Such falling air becomes colder as it approaches the floor and may attain a velocity of 150 fpm. A little recollection as to where frosting occurs on windows will prove the former and a puff of cigarette smoke will give indication of the latter.

By reason of this falling cold air, floor perimeters are characteristically cold.

In the panel case in point, if ceiling radiation is sufficient to transmit adequate energy to the floor so that perimeter temperature under windows, in spite of conduction loss and the constant bath of cold air, stays above indoor air dew point, then there will be no condensation.

With a given panel design, better perimeter insulation will always raise floor temperature but the real problem is to eliminate the "waterfall" of cold air.

There is little doubt that 1 in. of rigid insulation will not be sufficient to prevent condensation from an indoor atmosphere with prolonged minus 30 deg outdoor temperature.

With 1½ in. of waterproof insulation carried from the finished floor level down to the footings or around the slab perimeter and back 2 ft under it, and using convectors under windows, there will be no chance of condensation, in my experience.

This arrangement has an important comfort advantage in that the coldest air falling from the windows can be counteracted before it has a chance to reach and spread on the floor.—W. L. T.

HOW DRY FLOORS OF REFRIGERATOR CARS?

You are invited to answer the following questions from a reader of HPAC. Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"We have a problem of drying the floors of refrigerator cars after their cargoes of perishable vegetables have been unloaded and cars are returned to freight yards.

"These cars are cooled with ice and the loose ice can be shoveled out of the cars but the floors are left wet. We would like to use fans but in freezing weather we have to contend with a coat of ice on the floor and in weather above freezing, a wet floor.

"Equipment such as fans for drying the floors should be fairly portable. Electricity and steam are usually available. What type of fans should be used and how should they be placed? What method should be used to de-ice and dry the floor in freezing weather?"—C. L. B.

RIETSCHEL-BRABBEE HEATING DESIGN METHOD

IN THE APRIL issue of HPAC, in the Question of the Month department, "M.A.Y." asked about information on the Rietschel-Brabbee "Heizungs- und Luftungstechnik" method of calculating heat losses and sizing piping. He said he would like to know of an English translation of the method.

Perhaps the information he is seeking can be found in the book, Heating and Ventilation, by Rietschel and Brabbee, published in 1927 by the McGraw-Hill Book Co., Inc., New York City. — D.N.C.

[Editor's Note — This book is out of print and will not again be available. The publisher suggests that Barnes and Noble, 105 Fifth Ave., New York City, might be able to be of assistance in obtaining a copy. A copy is also available for reference at HPAC's offices.]

Sam Lewis' Page

. . . . . practical comment on pertinent problems

INFORMAL COMMENT on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, and a member of HPAC's board of consulting and contributing editors. His "Page" this month comprises excerpts from a talk he gave at a recent meeting of the Chicago section of the American Society of Refrigerating Engineers on "the role of the consulting engineer."

A CONSULTANT'S LIFE IS NOT A ROUTINE ONE

THERE ARE MANY different kinds of consulting engineers. My sort of consulting engineer serves as an independent adviser to the ultimate consumer and my job is to be a catalyst, endeavoring to suggest the best practicable equipment for each application. An important part of my task is to induce the owner and the architect to make enough space and to provide acceptable building construction so that the completed installation may give proper service.

This sort of consulting engineer, therefore, needs a background of general building construction, and must coordinate electric power, illumination, plumbing, heating, ventilating, air conditioning and automatic temperature control. He needs tact and originality in prevailing upon architects to design building structures that can be blended with the mechanical equipment in such manner as to give the latter a fair chance for good maintenance and successful operation.

This concept of the work of a consulting engineer does not by any means indicate an easy path, but it can give him an interesting and sometimes an exciting time. A few actual examples will illustrate the point.

I am much interested in radiant heating and have designed a great many successful plants, as well as having corrected some defective ones. Practice in promoting comfort in hot weather by aid of refrigeration, however, largely has been evidenced by blowing into a room air that is colder than the air in the room. It is not always possible to have the room well enough constructed to resist rapid heat passage, with the result that we often introduce too much air at too cool a temperature. If the necessity for heat removal can be lessened, then we can blow in less air and may save cost. This leads to the thought that some of the surplus heat could be removed by pipe coils in walls and ceilings, even as we often employ such coils to bring in part of the needed heat in winter.

Panel Cooling for Some Heat Removal

In considering heat removal by cooled wall and ceiling surfaces, there has always been the fear that the surfaces would reach the dew point temperature of the air and would get damp and perhaps odorous. If we can depend on thermostats to prevent drafts from cool morning air, we should be able to depend on them to employ temperance in the degree of coldness of the room surfaces.

Dr. Clarence A. Mills has built an exceedingly interesting research house in Cincinnati [see HPAC, December 1950]. He has insulated it so well that little heating except the surplus heat from the bodies of the people and the lights is required — even in cold weather. However, with this same very efficient insulation, and sometimes in cold weather, the rooms become too warm from surplus bodily heat, so that refrigeration is necessary. Dr. Mills has therefore installed a direct expansion "Freon" tube around the wall of each room, above a drained gutter, near the ceiling. The refrigerated coil is colder than the dew point, and the moisture condensed out of the air is drained away. Dr. Mills' experiments and experiences are an evidence of most interesting pioneering.

How to Ventilate Art Galleries

Some years ago, the late John Holabird and I wished to do a stunt along this line with some additional galleries at the Chicago art institute but unfortunately we were not allowed to try it out. Art galleries must have very potent illumination, and while traditionally they have skylights for solar light and heat, the sun intermittently has cloud trouble, and people often wish to visit art galleries at night and must have brilliant lighting.

Heating in an art gallery must be such that the heat will not damage old oil paintings. Another problem is that visitors to art galleries in winter generally wear or carry along their overcoats and so these galleries often tend to be too warm for their comfort.

The space between the glass ceiling of each gallery and the roof-level skylight is usually packed with electric lamps and this space becomes very hot indeed when the lights are energized.

I suggested, for the Chicago galleries, two separate ventilating systems, one using large volumes of air from outdoors, circulated in the upper part of each gallery, at a controlled temperature warmer than, say, 80 deg. The heating of this air, when it entered at a temperature cooler than the optimum, would be done by mixing some of the air with the too-warm electrically or solar heated air from the attic space between the ceiling and the skylight in each gallery.

The lower zone in each gallery, occupied by the visitors, however, would receive an entirely different

sort of air from a separate system. This air would be considerably cooler than 80 deg and it would be refrigerated and dehumidified as required. The air would enter through baseboard type slots at the gallery floor level and would be exhausted for recirculation or waste through outlets about halfway up the room, say 8 ft above the floor. Always being cooler and thus heavier than the air near the ceiling, this lower stratum could be kept separate (as by an invisible ceiling) and the refrigeration demand would be much less than that required for absorbing the heat from all of the air in the room, plus that from the electrically heated ceiling.

I applied most of the principles of this scheme in the galleries of the 300 ft long Toledo museum of art and found them to be practicable. Air will stratify in proportion to temperature, and in general practice we may not always have taken full advantage of this quality.

In considering air stratification, I remember the underground suburban railway station in a large eastern city in which it proved impossible to extract the heat from sun-warmed steel cars and from the electric motors and electrical resistance units under the cars, by employing downflowing air intended to enter exhaust ducts under the passenger platforms. The heated air would flow upward and the cooler air to replace that exhausted into the ducts under the platforms preferred to enter the station at a low level, flowing along the tracks. We reversed the scheme so that the exhaust outlets were overhead above the cars and so that the inlet ducts were under the platforms. This change alleviated the situation.

Chilled Water Piping Run Outdoors

We have a project for cooling a bank. It involves a 900 ton centrifugal "Freon" compressor for chilling water to be used in many separate, scattered air supply systems. A cooling tower on the roof is required. The refrigerated water must be piped to the various air conditioning machinery rooms and the condensers must have flow and return pipes to the cooling tower, which is about 28 stories above them. It was expedient and acceptable in this case to run these large water pipes outdoors.

We were able to run the mains and risers, merely insulated and waterproofed, in the large rectangular open interior court, which is entirely surrounded by the block-square office building.

A recent New York City skyscraper has similar chilled water pipes enclosed inside false piers on the face of the building. We did the same trick in an Indianapolis department store, with the vertical mains partially concealed in the exterior wall setbacks of the fire escapes.

Tact, Discretion Are Necessary

A consulting engineer constantly is compelled to exercise tact and discretion in his arguments. One prominent client years ago asked me to employ the space between a suspended ceiling and the structural ceiling for air distributing ducts. He yielded to my insistence that the delivery ducts must be sheet metal, but to reduce investment, I yielded to his desire to use the open space around the supply ducts above the ceiling as a return and exhaust suction chamber. This chamber, partly obstructed by beams and by the supply ducts, was inaccessible for cleaning.

They lived with the job for 10 years. Recently, the old acoustic ceiling began to fall down and I had it all torn out preparatory to replacement. The top of the old suspended structure was found to be loaded with enough dust almost to cause failure of the ceiling due to weight of the debris alone. The replaced construction, we may be assured, has cleanable, accessible exhaust-return ducts as well as supply ducts.

Occasionally, we encounter a client who thinks that one supply fan in a refrigerated ventilating project will suffice. He holds that a separate main exhaust fan is unnecessary and that the supply fan may be depended upon to take back part of the spent air for recirculation and to force out to the open air the percentage that will be replaced by new air from the main intake.

This alleged economy generally fails to pan out. On a hot day, the heavier 80 deg spent air strives manfully to refuse to be lifted up into the 95 deg circumambient atmosphere.

Some years ago, in speaking before the ASRE, I expressed willingness to employ a judicious amount of reheating in systems having rooms or departments that have different cooling requirements, even though there is an alleged inefficiency in cooling air and then in heating some of it in order to gain adequate temperature and relative humidity control. I still hold to this theory. We are successfully accomplishing it.

Use Reheat for Control

In one very large project we are using a local booster fan for each of many various departments. The local fan takes some 60 deg new air under automatic control and mixes it with some locally recirculated 80 deg air which does the necessary reheating to different degrees to suit each department. The recently completed Johnson Wax research tower, 14 stories high, all glass-enclosed and all cantilevered from a single very small central concrete stem, could hardly work without use of hot water reheaters on the refrigerated air supply in the 28 different zones of the tower.

This plant has grown from an original 150 ton refrigeration system to the present 350 ton system. The original two story office building had air delivery at but one temperature to all of the many rooms, regardless of intensity of occupancy or of solar exposure. Conditions were most unsatisfactory in either winter or summer. We corrected it two years ago in the only practicable manner, by installing separate hot water duct reheaters in the complicated and thoroughly concealed original air supply duct branches.

ALUMINUM PRODUCTION UP 19 PERCENT

THE U. S. ALUMINUM industry produced 19 percent more primary metal during 1950 than in the previous year, according to Donald M. White, secretary of the Aluminum Association, in announcing final production figures for the year. Primary production during the final quarter was 382,176,940 lb, to bring the year's total to 1,437,255,518 lb, he said.

"Production continues to rise," he reported, "and announced plans provide for increasing the industry's capacity by some 20 percent this year, and for further increases in 1952."

DATA sheet

Solar Irradiation of Walls and Windows

East and West: October-April

By F. W. Hutchinson

IN THE TWO preceding articles of this series (Heating, Piping & Air Conditioning, July 1949 and December 1950), solar angles and irradiation rates were given for south-facing walls and for southwest- or southeast-facing walls. This third article completes the presentation of tables for the seven month heating season (October through April).

Tables 9 through 12, presented herewith, are for morning irradiation of east-facing walls or afternoon irradiation of west-facing walls. By reference to the complete set of 12 tables, the designer now has sufficient direct-reading data to permit interpolation in finding the instantaneous irradiation rate on walls or windows facing any direction from east through south to west, and located at any latitude between 30 and 45 deg.

Irradiation rates for horizontal surfaces, as roofs or skylights, are not given in the tables, but can readily be obtained by noting that the true angle of incidence for any such surface would be equal to $90-H$, where H is the solar elevation as given in the second column of the tables. The irradiation rate for a horizontal surface is then $I_0 \cos (90-H)$. In most cases, the designer will find it unnecessary to refer to a table of trigonometric functions; knowing $90-H$, he will usually be able to find this same angle at some row of either the H, A or B column; hence, he can read the cosine from the corresponding column of the same row. For non-horizontal roofs or skylights the procedure would be as described on page 106 of the December 1950 issue.

For problems involving the sizing of equipment to meet a given heating or cooling load the interest of the designer will be primarily directed toward instantaneous values of the irradiation rate. In performance problems, however, he will be more concerned with the quantity of solar gain rather than with the maximum rate. As an example of the method of evaluating irradiation quantities, refer to Table 9 and consider that it is desired to know the total Btu received on a vertical east-facing wall during an average clear day of February. The table gives instantaneous irradiation rates for each hour from 7 a.m. to solar noon. Adding these six instantaneous values and dividing by six gives the average irradiation rate, expressed in Btu/(hr) (sq ft) for the morning hours. The actual hours of sunshine during a clear February morning (February 21st) amount to 5.65; hence, this number of hours multiplied by the average irradiation rate will give the total Btu striking 1 sq ft of east-facing vertical wall or window during an average, clear, February day.

The actual number of hours of the day that a wall is subjected to direct solar irradiation obviously depends on the month, the latitude, and the orientation of the wall. To assist the designer in calculating solar quantities for the cases represented in the 12 tables which have been presented, the numerical values of the maximum possible hours of irradiation have been grouped in the following tabulation:

Maximum Hours of Possible Irradiation

	South Wall	Southeast or Southwest Wall	East or West Wall
	30° Latitude		
October	11.1	7.9	5.7
November	10.5	8.1	5.3
December	9.7	8.0	5.0
January	10.5	8.1	5.3
February	11.3	8.0	5.7
March	12.0	7.8	6.0
April	9.0	7.6	6.5
	35° Latitude		
October	11.1	8.0	5.6
November	10.0	8.9	5.0
December	9.7	9.1	4.9
January	10.0	8.9	5.0
February	11.1	8.0	5.6
March	12.0	7.8	6.0
April	9.5	8.4	6.5
	40° Latitude		
October	10.7	8.0	5.4
November	9.6	7.9	4.8
December	9.2	7.8	4.6
January	9.6	7.9	4.8
February	10.7	8.0	5.4
March	12.0	8.2	6.0
April	10.0	8.4	6.7
	45° Latitude		
October	10.8	8.2	5.4
November	9.4	7.8	4.7
December	9.2	7.8	4.6
January	9.4	7.8	4.7
February	10.8	8.2	5.4
March	12.0	8.4	6.0
April	10.3	8.8	6.9

The author is professor of mechanical engineering at the University of California, Berkeley. These tables are from a project on solar heating sponsored by the Libbey-Owens-Ford Glass Co. and carried on at Purdue University in cooperation with the Purdue Research Foundation: G. Stanley Meikle, research director of the foundation; Carl F. Boester, research housing consultant.

Table 9

East or West Wall — Latitude 30°

Solar Time	Solar Altitude H	Azimuth A	B= A—90	cos H	cos B	cos i	i	Normal Intensity I_0	$I_0 \cos i$
October									
E W									
7am, 5pm	8	107	17	0.8903	0.9563	0.9470	18.74	149	141
8am, 4pm	18	117	27	0.9511	0.8910	0.8474	32.07	245	208
9am, 3pm	29	127	37	0.8746	0.7986	0.6984	45.70	279	195
10am, 2pm	39	141	51	0.7771	0.6293	0.4890	60.73	294	144
11am, 1pm	46	158	68	0.6947	0.3746	0.2602	74.92	301	78
12 noon	—	180	90	0.6561	—	—	90.00	—	—
November									
7am, 5pm	—	113	23	1.0000	0.9205	0.9205	23.00	—	—
8am, 4pm	13	123	33	0.9744	0.8387	0.8172	35.19	213	174
9am, 3pm	24	133	43	0.9135	0.7313	0.6680	48.09	271	181
10am, 2pm	32	147	57	0.8480	0.5446	0.4618	62.50	287	132
11am, 1pm	38	162	72	0.7880	0.3090	0.2435	75.91	297	72
12 noon	—	180	90	0.7660	—	—	90.00	—	—
December									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	11	123	33	0.9816	0.8191	0.8040	36.49	194	156
9am, 3pm	21	136	46	0.9336	0.6947	0.6486	49.56	265	172
10am, 2pm	29	148	58	0.8746	0.5299	0.4634	62.39	286	132
11am, 1pm	35	163	73	0.8191	0.2924	0.2395	76.14	296	71
12 noon	—	180	90	0.7986	—	—	90.00	—	—
January									
7am, 5pm	—	113	23	1.0000	0.9205	0.9205	23.00	—	—
8am, 4pm	13	123	33	0.9744	0.8387	0.8172	35.19	218	178
9am, 3pm	24	133	43	0.9135	0.7313	0.6680	48.09	277	185
10am, 2pm	32	147	57	0.8480	0.5446	0.4618	62.50	294	136
11am, 1pm	38	162	72	0.7880	0.3090	0.2435	75.91	304	74
12 noon	—	180	90	0.7660	—	—	90.00	—	—
February									
7am, 5pm	8	107	17	0.8903	0.9563	0.9470	18.74	152	144
8am, 4pm	18	117	27	0.9511	0.8910	0.8474	32.07	251	213
9am, 3pm	29	127	37	0.8746	0.7986	0.6984	45.70	286	200
10am, 2pm	39	141	51	0.7771	0.6293	0.4890	60.73	301	147
11am, 1pm	46	158	68	0.6947	0.3746	0.2602	74.92	308	80
12 noon	—	180	90	0.6561	—	—	90.00	—	—
March									
7am, 5pm	10	97	7	0.9848	0.9925	0.9774	12.20	182	178
8am, 4pm	25	105	15	0.9063	0.9659	0.8754	28.91	273	239
9am, 3pm	37	116	26	0.7986	0.8988	0.7178	44.13	295	212
10am, 2pm	49	130	40	0.6561	0.7660	0.5026	59.83	309	155
11am, 1pm	56	152	62	0.5592	0.4695	0.2625	74.78	313	82
12 noon	—	180	90	0.5000	—	—	90.00	—	—
April									
6am, 6pm	6	79	—11	0.9945	0.9816	0.9762	12.52	116	113
7am, 5pm	20	87	— 3	0.9397	0.9986	0.9384	20.21	255	239
8am, 4pm	32	96	6	0.8480	0.9945	0.8433	32.51	284	239
9am, 3pm	44	105	15	0.7193	0.9659	0.6948	45.99	299	208
10am, 2pm	56	118	28	0.5592	0.8829	0.4937	60.42	309	149
11am, 1pm	66	140	50	0.4067	0.6428	0.2614	74.85	315	82
12 noon	—	—	—	—	—	—	90.00	—	—

Table 10

East or West Wall — Latitude 35°

Solar Time	Solar Altitude H	Azimuth A	B= A—90	cos H	cos B	cos i	i	Normal Intensity I_0	$I_0 \cos i$
October									
E W									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	17	118	28	0.9563	0.8829	0.8443	32.40	239	211.00
9am, 3pm	27	128	38	0.8910	0.7880	0.7021	45.40	275	216.70
10am, 2pm	36	143	53	0.8090	0.6018	0.4868	60.87	291	175.10
11am, 1pm	41	160	70	0.7547	0.3420	0.2581	75.04	296	101.20
12 noon	—	180	90	0.7193	—	—	90.00	—	—
November									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	11	124	34	0.9816	0.9904	0.9722	13.54	191	185.70
9am, 3pm	21	135	45	0.9336	0.7071	0.6601	48.69	262	172.90
10am, 2pm	28	148	58	0.8829	0.5299	0.4678	62.11	280	131.10
11am, 1pm	32	163	73	0.8480	0.2924	0.2479	75.64	287	71.15
12 noon	—	180	90	0.8191	—	—	90.00	—	—
December									
7am, 5pm	—	—	90	1.0000	—	—	—	—	—
8am, 4pm	10	126	36	0.9848	0.8090	0.7967	37.18	179	144.80
9am, 3pm	17	137	47	0.9563	0.6820	0.6522	49.28	239	163.00
10am, 2pm	24	149	59	0.9135	0.5150	0.4704	61.94	267	137.50
11am, 1pm	29	164	74	0.8746	0.2756	0.2410	76.06	279	76.89
12 noon	—	180	90	0.8572	—	—	90.00	—	—
January									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	11	124	34	0.9816	0.9904	0.9722	13.54	196	190.50
9am, 3pm	21	135	45	0.9336	0.7071	0.6601	48.69	268	176.90
10am, 2pm	28	148	58	0.8829	0.5299	0.4678	62.11	287	134.20
11am, 1pm	32	163	73	0.8480	0.2924	0.2479	75.64	294	73.63
12 noon	—	180	90	0.8191	—	—	90.00	—	—
February									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	17	118	28	0.9563	0.8829	0.8443	32.40	245	216.30
9am, 3pm	27	128	38	0.8910	0.7880	0.7021	45.40	282	222.20
10am, 2pm	36	143	53	0.8090	0.6018	0.4868	60.87	297	178.70
11am, 1pm	41	160	70	0.7547	0.3420	0.2581	75.04	303	103.60
12 noon	—	180	90	0.7193	—	—	90.00	—	—
March									
7am, 5pm	10	98	8	0.9848	0.9903	0.9752	12.79	182	180.20
8am, 4pm	24	108	18	0.9135	0.9511	0.8688	29.68	271	257.70
9am, 3pm	35	120	30	0.8191	0.8660	0.7093	44.82	293	253.70
10am, 2pm	45	134	44	0.7071	0.7193	0.5086	59.43	305	219.40
11am, 1pm	52	155	65	0.6157	0.4226	0.2602	74.92	311	131.40
12 noon	—	180	90	0.5592	—	—	90.00	—	—
April									
6am, 6pm	7	80	—10	0.9925	0.9848	0.9774	12.20	135	132.90
7am, 5pm	20	90	—	0.9397	1.0000	0.9397	20.00	255	255.00
8am, 4pm	31	98	8	0.8572	0.9903	0.8489	31.91	282	279.30
9am, 3pm	42	108	18	0.7431	0.9848	0.7318	42.96	297	292.50
10am, 2pm	54	122	32	0.5878	0.8480	0.4984	60.10	308	292.50
11am, 1pm	62	146	56	0.4695	0.5592	0.2625	74.78	313	261.20
12 noon	—	180	90	0.4067	—	—	90.00	—	—

Table 11

East or West Wall — **Latitude 45°**

Solar Time	Solar Altitude H	Azimuth A	B= A—90	cos H	cos B	cos i	i	Normal Intensity I_n	$I_n$cos i
October									
E W									
7am, 5pm	8	108	18	0.9903	0.9511	0.9419	19.62	149	140.30
8am, 4pm	15	118	28	0.9659	0.8829	0.8528	31.48	227	193.60
9am, 3pm	24	131	41	0.9135	0.7547	0.6894	46.42	267	184.10
10am, 2pm	32	145	55	0.8480	0.5736	0.4864	60.89	284	138.10
11am, 1pm	37	162	72	0.7986	0.3090	0.2468	75.71	291	71.82
12 noon	39	180	90	0.7771	—	—	90.00	—	—
November									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	9	124	34	0.9877	0.8290	0.8188	35.03	166	135.90
9am, 3pm	16	136	46	0.9613	0.6947	0.6678	48.10	234	156.30
10am, 2pm	24	149	59	0.9135	0.5150	0.4704	61.94	271	127.50
11am, 1pm	28	163	73	0.8829	0.2924	0.2581	75.04	280	72.27
12 noon	29	180	90	0.8746	—	—	90.00	—	—
December									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	9	126	36	0.9877	0.8090	0.7990	36.97	168	134.20
9am, 3pm	14	138	48	0.9703	0.6691	0.6492	49.52	223	144.80
10am, 2pm	20	151	61	0.9397	0.4848	0.4556	62.90	261	118.90
11am, 1pm	24	165	75	0.9135	0.2588	0.2364	76.33	274	64.77
12 noon	25	180	90	0.9063	—	—	90.00	—	—
January									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	9	124	34	0.9877	0.8290	0.8188	35.03	170	139.20
9am, 3pm	16	136	46	0.9613	0.6947	0.6678	48.10	240	160.30
10am, 2pm	24	149	59	0.9135	0.5150	0.4704	61.94	277	130.30
11am, 1pm	28	163	73	0.8829	0.2924	0.2581	75.04	287	74.07
12 noon	29	180	90	0.8746	—	—	90.00	—	—
February									
7am, 5pm	8	108	18	0.9903	0.9511	0.9419	19.62	152	143.20
8am, 4pm	15	118	28	0.9659	0.8829	0.8528	31.48	232	197.80
9am, 3pm	24	131	41	0.9135	0.7547	0.6894	46.42	274	188.90
10am, 2pm	32	145	55	0.8480	0.5736	0.4864	60.89	291	141.50
11am, 1pm	37	162	72	0.7986	0.3090	0.2468	75.71	298	73.55
12 noon	39	180	90	0.7771	—	—	90.00	—	—
March									
7am, 5pm	9	98	8	0.9977	0.9903	0.9781	12.01	166	162.40
8am, 4pm	22	110	20	0.9272	0.9397	0.8713	29.39	265	230.90
9am, 3pm	32	123	33	0.8480	0.8387	0.7112	44.67	287	204.10
10am, 2pm	41	137	47	0.7547	0.6820	0.5147	59.02	300	154.40
11am, 1pm	47	157	67	0.6820	0.3907	0.2664	74.55	307	81.78
12 noon	50	180	90	0.6428	—	—	90.00	—	—
April									
6am, 6pm	8	81	— 9	0.9903	0.9877	0.9781	12.01	149	145.70
7am, 5pm	19	91	1	0.9455	0.9998	0.9453	19.04	250	236.30
8am, 4pm	30	101	11	0.8660	0.9816	0.8501	31.67	281	238.90
9am, 3pm	41	112	22	0.7547	0.9272	0.6997	45.60	296	207.10
10am, 2pm	51	128	38	0.6293	0.7880	0.4959	60.27	306	151.70
11am, 1pm	59	152	62	0.5150	0.4695	0.2418	76.01	311	75.20
12 noon	61	180	90	0.4848	—	—	90.00	—	—

Table 12

East or West Wall — **Latitude 45°**

Solar Time	Solar Altitude H	Azimuth A	B= A—90	cos H	cos B	cos i	i	Normal Intensity I_n	$I_n$cos i
October									
E W									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	13	119	29	0.9744	0.8746	0.8522	31.55	210	17.00
9am, 3pm	22	132	42	0.9272	0.7431	0.6890	46.45	262	180.50
10am, 2pm	27	146	56	0.8910	0.5592	0.4982	60.12	275	137.00
11am, 1pm	32	163	73	0.8480	0.2924	0.2479	75.64	284	70.40
12 noon	—	180	90	0.8290	—	—	90.00	—	—
November									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	8	125	35	0.9903	0.8191	0.8111	35.80	150	121.70
9am, 3pm	13	137	47	0.9744	0.6820	0.6645	48.36	213	141.50
10am, 2pm	17	150	60	0.9563	0.5000	0.4781	61.44	242	115.70
11am, 1pm	22	164	74	0.9272	0.2756	0.2555	75.20	265	67.71
12 noon	—	180	90	0.9135	—	—	90.00	—	—
December									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	9	127	37	0.9877	0.7986	0.7888	37.93	168	132.50
9am, 3pm	11	139	49	0.9816	0.6561	0.6440	49.91	194	124.90
10am, 2pm	13	152	62	0.9744	0.4695	0.4575	62.77	215	98.36
11am, 1pm	18	165	75	0.9511	0.2588	0.2461	75.75	251	61.77
12 noon	—	180	90	0.9272	—	—	90.00	—	—
January									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	8	125	35	0.9903	0.8191	0.8111	35.80	154	124.90
9am, 3pm	13	137	47	0.9744	0.6820	0.6645	48.36	218	144.90
10am, 2pm	17	150	60	0.9563	0.5000	0.4781	61.44	248	118.60
11am, 1pm	22	164	74	0.9272	0.2756	0.2555	75.20	271	69.24
12 noon	—	180	90	0.9135	—	—	90.00	—	—
February									
7am, 5pm	—	—	—	—	—	—	—	—	—
8am, 4pm	13	119	29	0.9744	0.8746	0.8522	31.55	215	183.20
9am, 3pm	22	132	42	0.9272	0.7431	0.6890	46.45	268	184.60
10am, 2pm	27	146	56	0.8910	0.5592	0.4982	60.12	282	140.50
11am, 1pm	32	163	73	0.8480	0.2924	0.2479	75.64	291	72.14
12 noon	—	180	90	0.8290	—	—	90.00	—	—
March									
7am, 5pm	8	101	11	0.9903	0.9816	0.9721	13.56	150	145.80
8am, 4pm	20	111	21	0.9397	0.9336	0.8773	28.68	258	226.30
9am, 3pm	29	124	34	0.8746	0.8290	0.7250	43.53	282	204.40
10am, 2pm	38	140	50	0.7880	0.6428	0.5065	59.57	297	150.40
11am, 1pm	44	160	70	0.7193	0.3420	0.2460	75.76	303	74.54
12 noon	—	180	90	0.7071	—	—	90.00	—	—
April									
6am, 6pm	8	62	—28	0.9903	0.8829	0.8743	29.04	149	130.30
7am, 5pm	18	93	3	0.9511	0.9986	0.9498	18.23	245	232.70
8am, 4pm	30	105	15	0.8660	0.9744	0.8458	32.46	281	237.10
9am, 3pm	39	117	27	0.7771	0.8910	0.6924	46.18	294	203.60
10am, 2pm	47	133	43	0.6820	0.7313	0.4987	60.90	303	151.10
11am, 1pm	54	154	64	0.5878	0.4384	0.2577	75.07	308	79.37
12 noon	—	180	90	0.5592	—	—	90.00	—	—

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Furnace Thermal Efficiency Determined From Flue and Jacket Loss

By Howard L. McPherson,* Karl L. Badger** and Walter S. Zawada,** Cleveland, Ohio

SUMMARY—In determining thermal efficiency of gas-fired, warm-air furnaces it has been found satisfactory to obtain the efficiency as a difference between the heat input and the sum of the flue gas loss and heat loss from the exposed furnace surface.

Temperatures were determined for 6-in. square units of exposed furnace surface by means of thermocouples. Coefficients for convective and radiant heat loss were obtained from charts based on the temperature difference between surfaces and room air, and were used in an equation to find total heat loss from the surface.

Following a comparison of results with those obtained by measuring the air flow by an electrical method, and also by orifice meters in furnace air inlet or outlet, it was concluded that the simpler method was satisfactory, and it was therefore adopted by the *AGA* Laboratories for determining efficiency in tests for approval of warm-air, gas-fired furnaces.

THE THERMAL efficiency of central heating warm-air furnaces now may be determined by a simplified flue and jacket loss procedure that may be readily applied by manufacturers of appliances in their own test work.

Selected from a number of methods investigated by the *AGA* Laboratories at the request of the Subcommittee on Approval Requirements for Central Heating Gas Appliances, the new procedure eliminates the use of an air flow measurement device, thereby reducing considerably the time and effort required for the test without diminishing the precision of the former procedure. The committee has adopted the new procedure for determining the thermal efficiency of all central heating warm air furnaces whether of the forced air or gravity type. It does not however, apply to floor furnaces for which separate requirements exist.

Previous Test Method

The standard test method for determining the thermal efficiency of gas-fired warm-air furnaces was initially established by the committee in 1927. This procedure required measurement of the air flow rate and of the air temperature rise during its passage through the furnace, to determine the amount of heat transferred to the outlet air stream. The ratio of the heat acquired by the air stream to the heat supplied to the furnace by the gas consumed, was taken as the thermal efficiency of the unit. Flue loss also was measured and the remaining balance of the heat supplied was charged to jacket and unaccounted for losses.

While this method proved adequate for a period of some 18 years, the procedure became increasingly involved as various refinements were adopted. For this reason the study of alternate test methods was made, and the precision of such procedures was carefully compared with that of the established method. The study covered both gravity and forced air furnaces. The major factor complicating the established standard procedure for determination of thermal efficiency is the measurement of the air flow through the furnace. Since a precision within one percent is required, the *AGA* Laboratories have been measuring air flow by an electrical method.

The method determines indirectly the rate of air flow passing through it by measurement of independently applied heat necessary to produce a constant temperature rise of the

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For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Portland, Ore., July 1951.

air stream. The heat is supplied electrically and is measured in terms of watts. For accuracy the air temperature cannot exceed the range of normal ambient temperatures. Consequently, air flow must be measured as it passes through the instrument prior to entering the furnace inlet. Flow rates are limited to those below 1700 cfm. The design of a meter for employing the electrical method places certain restrictions on the method in which it may be used. While the electrical method is satisfactory for the purpose, constant supervision of the procedure is essential and a period of at least 20 min is required to determine a single flow rate.

An alternate means of determining the amount of heat (or thermal efficiency) delivered at the outlet of a furnace under service conditions is to measure air flow through the outlet connection. In order to do so, however, a flow measuring device capable of operating under a wide range of air flow rates and at temperatures of from 140 to 190 F, is required.

Air Flow Measurement

In order to assist in the preliminary evaluation of the precision and practicability of various methods for measuring air flow, a literature survey was made. This indicated that an orifice plate or nozzle employed as an air flow measuring device appeared to offer possibilities. Among other metering devices or methods reviewed were Pitot tubes, anemometers of both swing vane and rotating vane types, thermocouple and resistance anemometers, thin plate orifices, nozzle type orifices, and venturi meters. Devices which measure air velocity at a point, requiring a number of velocity determinations over a given cross-sectional area of duct in order to determine the flow, were discarded since a number of readings must be taken and averaged. Devices of this type include the various anemometers and the Pitot tube. Advantages and disadvantages of the various types of air measuring instruments are shown in Table 1.

Table 1—Advantages and Disadvantages of Various Air Metering Devices

Measuring Instrument	Advantages	Disadvantages
1. Pitot tube	Precision high. Convenient in measuring velocity at any point within the air stream.	Point measurement. Traverse readings necessary. A velocity head of 0.005 to 0.020 in. of water in the outlet duct would require a micromanometer to indicate differential pressure accurately.
2. Anemometer; swinging vane or rotating vane	Easily operated. Convenient to measure velocity at a point within the air stream.	Point measurement. Limited precision from 5 to 15 percent. Must be calibrated repeatedly.
3. Thermocouple or resistance anemometer	Precision high when properly calibrated. Excellent for very low velocities.	Point measurement. Very small diameter wires required making instrument too delicate for general use in furnace testing.
4. Thin plate square edge orifice plate	(a) Inexpensive and easy to construct (b) Instantaneous accurate reading (c) Gives large pressure differential at low rates of flow (d) Minimum human element involved.	(a) Requires 10 duct diameter upstream and 5 duct diameter downstream (b) Requires blower to overcome resistance of orifice plate
5. Air flow nozzles	Same advantages as for orifice plate.	More difficult to construct than orifice plate and gives less pressure drop at equivalent flow through orifice of equivalent diameter.
6. Electric air meter	Precision within 1 percent.	(a) Expensive (b) Limited to measurement of air at room temperatures (c) Large and bulky (d) Requires skillful manipulation (e) Limited flow capacity.
7. Venturi meter	(a) Instantaneous accurate reading (b) Low overall pressure drop (c) Wide range of flow and temperature for single meter.	(a) Expensive to construct (b) No interchangeable parts as in orifice meter (c) Less pressure differential than orifice meter.

Thin plate orifices, nozzles, Venturi meters, and the electrical method indicate air flow in a given duct section with approximately the same precision. Venturi meters, thin plate and nozzle orifice meters have, in general, comparable operating characteristics. The Venturi meters are not of so simple construction as orifice meters and require replacement of the entire meter section when the flow rate exceeds the meter capacity. Orifice meters, on the other hand, may be readily changed from one meter capacity to another by changing orifices.

Thin plate orifices are readily constructed from flat sheet steel, are relatively durable and may easily be replaced. The only machining operation required is to size the orifice and diameter accurately. Aside from these factors, no appreciable advantages are offered by thin plate orifices over nozzle orifices which require accurate machining of a curved surface.

Comparison of Air Measurement Methods

In order to determine practical relations between operation of orifice meters and the electric air meter, tests were conducted with each of three sizes of orifice meters, including 3 and 6 in. diameter orifices enclosed in 12 in. diameter ducts and a 3 in. diameter orifice enclosed in a 6 in. diameter duct connected in series with the electric air meter. The orifice meter and the arrangement of test apparatus are shown in Figs. 1 and 2, respectively.

Results of these tests are shown graphically in Figs. 3 and 4. In Fig. 3, rate of flow in cubic feet per minute as determined by the electric method had been plotted against the

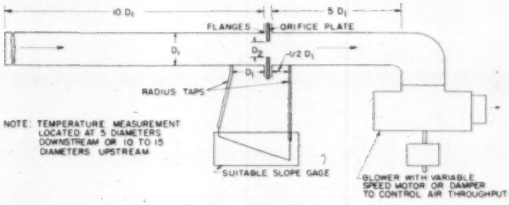


Fig. 1—Construction of orifice meter

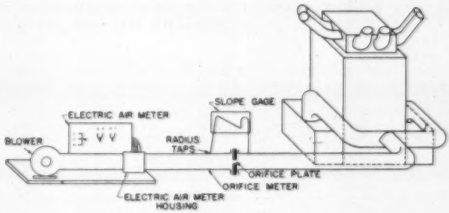


Fig. 2—Arrangement of apparatus for determining thermal efficiency of gravity or forced air furnaces with air flow meters connected to furnace air inlet (gravity type shown)

rate of flow found by the orifice meter. In Fig. 4, for each flow rate, rate of flow as determined by the electric method has been plotted against the observed pressure drop across the orifice under test. Fig. 4, also shows the theoretical curves for flow *vs.* pressure drop based on the equation:

$$Q = k\sqrt{\Delta P}$$

where

Q = flow, cubic feet per minute.

ΔP = pressure drop across the orifice inches water column.

k = constant secured from *Flow Measurements, ASME*, 1940.

It is evident from examination of Figs. 3 and 4 that results of orifice and electrical determinations virtually coincide, indicating close agreement. In the case of Fig. 3, deviation from a straight line with slope equal to 45 deg would indicate appreciable differences in flow rate as determined by the two methods.

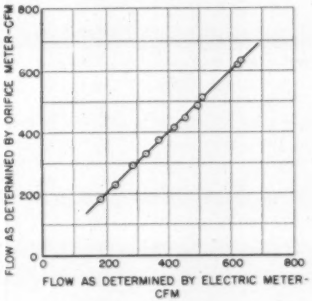


Fig. 3—Comparison of flow rates as determined by electric and orifice meters

Flue and Jacket Loss Determination

Approaching the study with the purpose of eliminating the use of a flow metering device, it was decided to compare a flue and jacket loss test procedure with the established test method. Such a procedure could be employed by manufacturers at their plants with a minimum of equipment and also by the *AGA* Laboratories for routine testing. With this procedure, the heat carried away by the flue gases and the heat loss by convection and radiation from the jacket is subtracted from total heat input to the appliance.

The percentage of heat carried away by the flue gases was determined from charts showing flue loss as the function of the temperature and CO_2 content of flue gases.

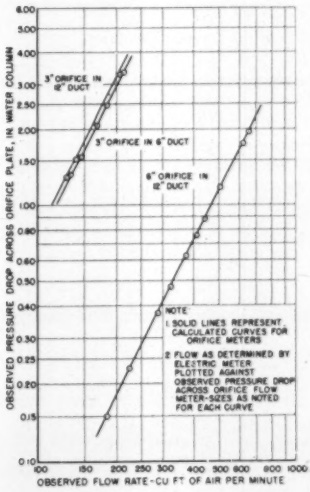

OBSERVED PRESSURE DROP ACROSS ORIFICE PLATE, IN WATER COLUMN
OBSERVED FLOW RATE-CU FT OF AIR PER MINUTE
3" ORIFICE IN 12" DUCT
3" ORIFICE IN 6" DUCT
6" ORIFICE IN 12" DUCT
NOTE
1 SOLID LINES REPRESENT CALCULATED CURVES FOR ORIFICE METERS
2 FLOW AS DETERMINED BY ELECTRIC METER PLOTTED AGAINST OBSERVED PRESSURE DROP ACROSS ORIFICE FLOW METER-SIZES AS NOTED FOR EACH CURVE

Fig. 4 *(left)*—Electric meter flow *vs.* pressure drop across orifice meter

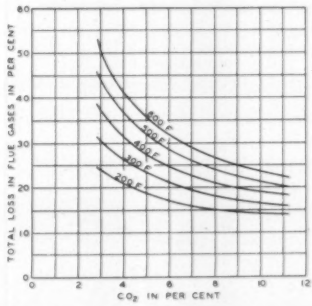


Fig. 5—Alignment chart for calculation of flue losses for natural gas 1060-1190 Btu

(Curves show flue gas minus room temperature)

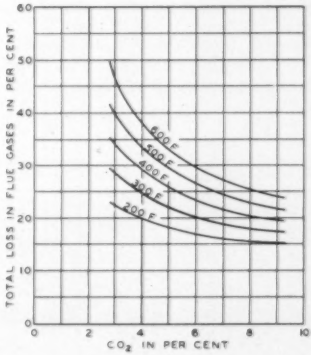


Fig. 6—Alignment chart for calculation of flue losses for coke oven gas 520-590 Btu

(Curves show flue gas minus room temperature)

Table 2—Comparison of Thermal Efficiency Tests on *Gravity* Warm Air Gas Furnaces

Appliance	Meter	Position	Input Btu/hr	Heat Delivered at Duct Outlet %	Duct Loss %	Thermal Efficiency %	Flue Loss %	Jacket Loss %	Heat Balance
A	Electric Meter	Inlet	70,400	68.8	5.2	74.0	20.6	4.9	99.5
	Orifice Meter	Inlet	70,400	69.2	5.2	74.4	20.6	4.9	99.5
	Orifice Meter	Outlet	67,000	67.4	5.6	73.0	21.2	4.9	99.1
B	Electric Meter	Inlet	118,200	65.0	6.2	71.2	26.5	1.0	98.9
	Orifice Meter	Inlet	118,200	64.6	6.2	70.8	26.5	1.0	98.3
	Orifice Meter	Outlet	118,400	64.9	6.0	70.9	26.8	1.2	98.9

Table 3—Comparison of Thermal Efficiency Tests on *Forced* Warm Air Gas Furnaces

Appliance	Meter	Position	Input Btu/hr	Heat Delivered at Duct Outlet %	Duct Loss %	Thermal Efficiency %	Flue Loss %	Jacket Loss %	Heat Balance
C	Electric Meter	Inlet	95,800	74.1	2.0	76.1	22.8	1.6	100.5
	Orifice Meter	Inlet	95,800	73.6	2.0	75.6	22.8	1.6	100.0
	Orifice Meter	Outlet	96,500	73.0	2.1	75.1	23.2	1.6	99.9
D	Electric Meter	Inlet	84,000	73.0	2.5	75.5	21.0	3.1	99.6
	Orifice Meter	Inlet	84,000	72.8	2.5	75.3	21.0	3.1	99.4
	Orifice Meter	Outlet	83,800	72.6	2.5	75.1	20.7	3.1	98.9

Charts employed when using natural or manufactured gases are shown in Figs. 5 and 6. Jacket temperatures were measured by means of a surface type thermocouple.

The jacket losses of the appliances used during the study were calculated from formulas recorded in the literature for calculating heat transfer from surfaces commonly encountered in central heating appliances, together with convection and radiation coefficients.

For a given jacket area, the Btu heat loss may be expressed as:

$$q = (h_c + h_{rs})\, A_s\, (t_1 - t_2) \quad \ldots (1)$$

where

q = heat loss per hour, Btu,

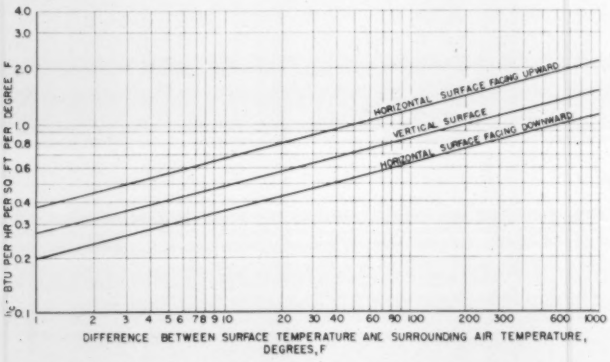

HORIZONTAL SURFACE FACING UPWARD
VERTICAL SURFACE
HORIZONTAL SURFACE FACING DOWNWARD
BTU PER HR PER SQ FT PER DEGREE F
DIFFERENCE BETWEEN SURFACE TEMPERATURE AND SURROUNDING AIR TEMPERATURE, DEGREES, F

Fig. 7—Convection coefficients for vertical and horizontal surfaces

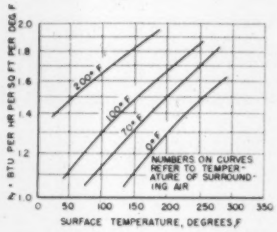


Fig. 8—Coefficient of heat transfer by radiation for emissivity of 1.0

h_c = coefficient of convection, Btu per (hour) (square foot) (Fahrenheit degree).

h_{rs} = coefficient of radiation for surfaces in question, Btu per (hour) (square foot) (Fahrenheit degree).

A_s = area of surface considered, square feet.

t_1 = temperature of surface considered, Fahrenheit degrees.

t_2 = temperature of surrounding air, Fahrenheit degrees.

In the beginning an average temperature was established for the entire jacket of the unit undergoing test. This average temperature was then used in Equation 1. An average value of h_{rs} and h_c was also employed to calculate jacket loss in that equation. However, since convection and radiation coefficients vary with temperature, a more precise evaluation of the jacket loss could be made by collecting the total surface areas whose temperatures were approximately the same and determining the h_c and h_{rs} for those surfaces. In this manner a number of Q values would be obtained and their sum would be the total jacket heat loss of the unit.

The exact procedure employed is as follows: The jacket surfaces were subdivided into 6 in. squares and the surface temperature of each square was measured. The area of all squares with temperatures less than 100 F above room temperature, in increments of 10 deg, were totaled. For example, if room temperature was 80 F, areas of squares whose temperatures were between 80-90 F, 90-100 F, 100-110 F, and so

on to 180 F were determined. The coefficients were then determined for each group of squares from Figs. 7 and 8. Q was established for each group from Equation 1. This procedure was followed with surfaces whose temperatures were more than 100 deg above room except that areas were collected at increments of 20 deg apart. The total of all the Q values obtained then was the jacket and duct loss of the unit.

Since Fig. 8 is based on emissivity of 1.0, coefficients of radiation h_r obtained therefrom must be multiplied by the emissivity of the surface under consideration to obtain the corrected coefficient of radiation h_{r_c}. While an average emissivity factor of 0.9 may be used for most jacket surfaces employed with central heating equipment, emissivities for various jacket surfaces may be ascertained from the literature when greater accuracy of results is desired.*

**Heat Transmission*, by W. H. McAdams (McGraw-Hill Book Co., Second Edition, 1942).

Conclusion

For purposes of comparison, three test methods were employed for determining thermal efficiency of gravity furnaces selected during the study. These methods consisted of (1) the present method as outlined in the requirements for central heating gas appliances, wherein the furnace jacket was sealed and air measurement made at the furnace inlet by electrical method, (2) a similar method employing an orifice meter for measuring air, and (3) a method using the flue loss and jacket loss of the furnace. Results are given in Table 2. Likewise, similar tests were conducted on forced warm air furnaces, with results shown in Table 3.

From Tables 2 and 3 it may be noted that if the flue and jacket loss in each test method are added and then subtracted from 100 percent, the resulting thermal efficiency is very close to that obtained by either of the three methods employed to obtain thermal efficiency by evaluating the sensible heat transferred to the air throughout.

Since the flue and jacket loss procedure gave results comparable in accuracy to other methods and had the advantage of materially reducing testing time, equipment and expense, the committee adopted it as a regular test procedure supplanting the old standard method. It is now in use at the *AGA* Laboratories for determining the thermal efficiency of all central heating warm air furnaces of other than floor furnace types.

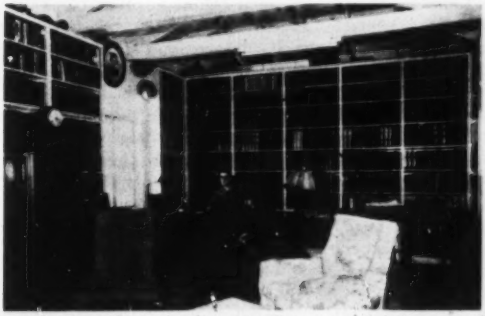
Florida Wonderful, New Resident Reynolds Reports

It's wonderful — I'm sorry I didn't do it long ago, ASHVE member T. W. Reynolds wrote recently in a note telling about his new home in Florida, and, judging by the photographs that were attached, his feelings are entirely justified.

Mr. Reynolds, who is retired except for some occasional technical writing, is living in a pretty little white house in a community known as Palm Beach Shores. The house has many outstanding features, Mr. Reynolds reports, and he is particularly happy about the handsome studio where he works and which contains his more than 3,000 books. The studio may be seen in the photo on this page, showing, as Mr. Reynolds puts it, *the king himself, complete with Florida crew haircut, seated near typewriter rusting in the salt air and a fishing pole ready at a moment's notice in case of writer's cramp.*

Beyond the trees in the background of the other photo (showing Mr. Reynolds' wife and daughter seated on the patio) is a man-made inlet which links up with an internal boatway to Florida's coast. *Naval vessels passing through seem almost to be sailing across the pasture itself*, he said. A natural inlet that was closed by a hurricane is about equal distance from the front of the house. Before the construction of the inlet, the land was connected to the island of Palm Beach; hence the community name Palm Beach Shores.

In closing, Mr. Reynolds joked about the fact that there was no furniture on the patio, giving as the reason *an overdrawn treasury allotment*, and saying, *will buy in March, — cheaper.* The treasury allotment may be temporarily overdrawn, but if the tone of Mr. Reynold's letter is any indication, he is very rich in state of mind.



T. W. Reynolds in handsome studio, surrounded by part of 3000-book collection

Mrs. Reynolds and daughter enjoy a chat on patio of Florida home

JOURNAL SECTION

NATIONAL BUREAU OF STANDARDS SEMI-CENTENNIAL

The year 1951 marks the fiftieth anniversary of the National Bureau of Standards. A large number of the principal scientific and technical organizations of the nation, in recognition of the role of the Bureau in science, have planned meetings in Washington in 1951 to honor the Bureau's Semi-Centennial.

The present remaining calendar of major meetings is as follows: Bone Char Conference II, May 3-4; *Acoustical Society of America*, May 10-12; *Horological Institute of America*, May 14-15; *Society for Experimental Stress Analysis*, May 16-18; National Conference on Weights and Measures, May 22-25; *Analytical Division of the American Chemical Society*, June 14-16; *American Astronomical Society*, June 21-23; *Illuminating Engineering Society*, August 26-31, September 1; International Union of Chemistry, September 13-15; *American Roentgen Ray Society*, September 25-28; *American Dental Association*, October 15-20; *National Institute of Governmental Purchasing*, October 21-24; *Institute of Mathematical Statistics*, October 26-27; *American Mathematical Society*, October 27; Conference on Electrical Insulation (NRC), October 29-31; and APS Division of Electron Physics, November 1-3.

In addition, a number of committee conferences and meetings of local sections of societies will be held at the National Bureau of Standards. The Bureau is also planning a series of symposia on special topics, to be held during the year.

Created by Act of Congress on March 3, 1901, the Bureau is the principal agency of the Federal Government for fundamental research in physics, mathematics, chemistry, and engineering. The Bureau's activities are thus largely concerned with the physical sciences although the close inter-relationships of the major fields of science preclude the drawing of sharp lines of distinction. Considerable work, for example, is undertaken in biochemistry and biophysics, particularly projects relating to materials, processes, and instrumentation.

The history of the Bureau actually extends back to the Constitution, which gave cognizance of weights and measures to the Federal Government. An Office of Weights and Measures grew out of various acts of Congress beginning in 1830, and this Office was the immediate antecedent of the Bureau.

At the close of the last century, American industry and science recognized the need for a major, national physical laboratory similar to those established in England and Germany. Problems relating to fundamental standards of science, physical constants, properties of materials, and methods and instruments of measurement called for a laboratory that would serve the entire nation. Industry, in particular, had needs for fundamental standards of measurement and access to a source of calibration of industrial and laboratory working standards.

All working standards in research laboratories and industry, are calibrated in terms of the national standards of physical measurement which the Bureau maintains. In addition, the Bureau carries on necessary research leading to improvements in such standards and in related measurement methods and instruments. New standards, methods, and instruments, in keeping with demands for greater precision and the opening up of new fields of science and industry, are also objects of research.

An equally significant aspect of the Bureau's work is that concerned with specific research and development projects in the physical sciences and mathematics. Some of these projects are related to fundamental standards, properties of materials, and physical constants as well as measurement problems. For example, the development of the atomic clock is directly related to the Bureau's interest in a better standard of time and frequency, and it is also linked to problems in the field of microwave spectroscopy. Others of these projects range in subject matter from pure research in mathematics, in nuclear physics, and in supersonic aerodynamics to the development of guided missiles, proximity fuses, and automatic electronic computing machines.

The scope of the Bureau's work is suggested by the names of its fifteen divisions: electricity, optics and metrology, heat and power, atomic and radiation physics, chemistry, mechanics, organic and fibrous materials, metallurgy, mineral products, building technology, applied mathematics, electronics, ordnance development, radio propagation, and missile development. The divisions in turn consist of several sections, totalling 108, organized as logical units of the divisions. In addition to laboratory work, the Bureau, by virtue of its staff and facilities, is called upon to render scientific advisory services to the Government and industry. Its participation in the activities of scientific and engineering societies and bodies, both nationally and internationally, is necessarily extensive and varied.

SOUTH BOOMING, *ASME* HEARS

The South is booming and must now be considered the nation's No. 1 region of opportunity, F. F. Groseclose, director of the School of Industrial Engineering, Georgia Institute of Technology, told members of the *ASME* at the group's recent spring meeting in Atlanta, Ga. Once termed this country's biggest economic headache by F. D. Roosevelt during the early days of his presidency, the land of black-eyed peas and magnolias now shows greater increases percentage-wise in the value of manufactured products, value added by manufacture, and per-capita income during the past ten years than the United States as a whole, while the increase in actual annual expandable income in the South since 1940 was 357 percent, the greatest in the history of the nation. And it's only the beginning of what the South can do with the labor, natural resources, markets, and power facilities at its command, said Colonel Groseclose, a veteran of two world wars, now on research and development mobilization assignment to the Army General Staff.

Design Factors in Panel and Air Cooling Systems

By Charles S. Leopold*, Philadelphia, Pa.

SUMMARY — Engineering of panel cooling systems. Suspended ceilings consisting, in part, of cooling panels. Test data applicable to suspended ceilings incorporating cooling panels. Performance of conventional air cooling and panel cooling systems analyzed with the aid of a hydraulic analogue. Temperature variations within a zone.

THE PERFORMANCE of a cooled panel is better than would be anticipated by the calculations used for panel heating as the major internal sensible loads for which cooling is required appear in significant proportion as short wave length radiant energy, which is usually not recognized in panel heating. Since the air is substantially transparent† to radiation, it is not directly warmed by radiation. Radiant energy may be converted into thermal energy when it strikes a solid. The amount of radiation reflected and the amount converted into thermal energy depends on the absorptivity of the surface, the difference in the fourth powers of the absolute temperatures of the source and sink, and their geometry. For sunlight, and for large portions of the energy emitted by a luminaire, there is such a large difference between the temperatures of the source and the structure that the conversion of radiant energy to thermal energy is practically independent of the surface temperature of the structure. Where radiant energy impinges upon a cooled panel, a portion of the radiation which is converted to thermal energy is removed even though that panel be at or somewhat above the room air temperature. The portion of radiant energy which can be so removed has been measured and named Independent Radiant Transfer[1] (IRT).

The radiant energy absorbed by the surface of walls, floor, or uncooled portions of a ceiling is, in part, conducted into the structure and, in part, transferred to the air by convection or to other room surfaces by re-radiation.

In conventional systems using only air for cooling, it would be expected that surfaces not provided with means of cooling would tend to rise above the room air temperature. The fact that the surface of the structure is directly warmed by absorption of radiant energy would also indicate that with a conventional cooling system there will be an increase in thermal storage even though cool air is supplied in quantity to maintain a constant room air temperature.[1,2]

Test Data

Data have been presented[1] on the performance of a continuous, cooled metal ceiling, with various types of luminaires, in a test structure controlled so as to simulate a condition of thermal equilibrium between room air and structure.

Data have been presented[3] for the solar load in a room with a continuous, cooled metal ceiling, a 10-in. cinder concrete floor, and with various arrangements of glass and shading devices. Tests were conducted to simulate the effects of thermal storage, with the under side of the floor slab maintained at a constant temperature corresponding to design room air temperature.

For these tests, the room and fenestration were represented by a scale model of the building then being studied and solar radiation was simulated by a combination of a mercury vapor lamp and filament reflector spots.

Appendix A contains subsequent data on panel performance for a suspended ceiling consisting, in part, of cooling panels and, in part, of perforated metal in conjunction with sound-absorbing pads.

For the test with luminaires, 29 percent of the suspended ceiling was cooled. Tests were conducted with and without the storage effects of a 10-in. cinder concrete slab.

For the tests with solar heat and shading devices, 40 percent of the suspended ceiling was cooled. The experiments were otherwise conducted as previously described.[3]

Panels

General: Theoretical considerations corroborated by the tests previously outlined indicated that it was not necessary to cool the entire ceiling in order to utilize coolant temperatures safely above the dew point.

Applied sound-absorbing materials are generally of low thermal conductivity. Cooling pipes imbedded in the actual ceiling structure would be effective but are open to some objection on the basis of complicating the application of acoustic treatment and in that they would require the coolant to be at lower temperature than would be required with a metal ceiling because of the temperature drop, coolant to surface.[4] Despite this limitation, cooling by tubes imbedded in plaster or concrete is feasible.

Cooling panels can be perforated to allow for sound-absorbing media above without materially affecting their thermal performance but a greater economy in the use of materials may result when only a portion of the ceiling is in the form of panels

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†*Heat Transmission*, by W. H. McAdams (2nd Edition, pp. 64-70).
Presented at the 57th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Philadelphia, Pa., January 1951.

[1]Exponent numerals refer to Bibliography.

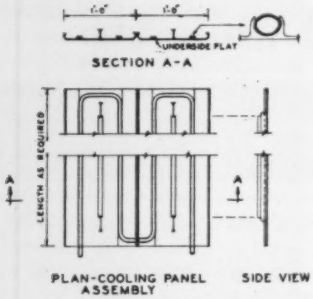

Fig. 1—Cooling panel detail

and the remainder in less expensive materials, such as conventional metal pan acoustic ceilings.

One System: For the acoustic treatment of the ceiling as perforated panels will usually be sufficient. The general acceptance of acoustic treatment in modern office buildings led to the thought of introducing the cooling panels and acoustic panels in a form which would fit the ordinary suspension for a perforated acoustic ceiling. Cooling panels were designed as shown in Fig. 1. The basic material is an aluminum extrusion, approximately 0.062 in. thick, with channels on the top in which copper tubes are placed in close fit and then deformed to provide thermal contact. Tubes can be deformed either by flattening or by expanding. Copper tubing was selected because of its ease of assembly and its known resistance to corrosion. The panels fit into a typical ceiling suspension as shown in Fig. 2. They can be arranged in pattern as desired and, if it were necessary, the cooling panels could be perforated for additional acoustic treatment.

Cooled Luminaire: Exploiting the idea of removing as much energy as possible at the source, led to the design of the panels in part as the reflector for a lighting fixture, as shown in Fig. 3. The performance per unit area of such a panel is higher than a normal ceiling panel since much of the radiation, as well as convected and conducted heat, is directly intercepted before it warms other room surfaces or the room air.

With any type of cooling panels forming a part of a suspended ceiling, the upper surface of the panel receives heat energy from the air above and by radiation from the under side of the floor slab or roof above. The air above a suspended ceiling is warmed by heat conduction through the ceiling structure which is not directly cooled and may be warmed by auxiliaries of the lighting system. There is some conduction from the uncooled portion of the ceiling to the cooled panel, in amount depending upon materials of construction of the uncooled ceiling and the conductive properties of the bond.

Use of the luminaire panel is desirable where recessed fluorescent lighting is to be used. Where applicable, it has the mechanical and aesthetic advantage of reducing the number of different types of elements which form the ceiling. With flat plates, unless the plate is perforated to match the ordinary cheaper mate-

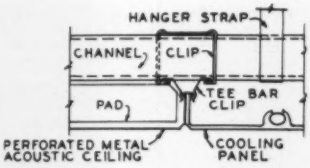

Fig. 2—Method of suspension

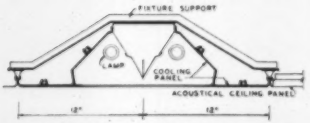

Fig. 3—Troffer luminaire panel

rials of construction used for the acoustic pans, there are four elements; namely, the air grille, the acoustic pans, the cooling panel and the luminaire. With the cooled luminaire, the identity of the cooling panel is lost, thus removing one element. This is important in design as it is easier to obtain symmetry with the three elements than four.

In general, the design of a suspended ceiling panel cooling system will require from 20 to 40 percent of panel. Fig. 4 shows a reflected ceiling plan using recessed fluorescent lighting and flat panels. Fig. 5 is a sample ceiling using the luminaire cooling panels.

Below Window: The flat panel can also be used as a heating and cooling means below the window, and one method of application is shown in Fig. 6. The panel is used for cooling in summer and provides a cool surface to counterbalance the

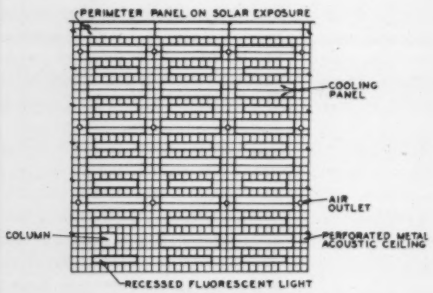

Fig. 4—Reflected ceiling plan

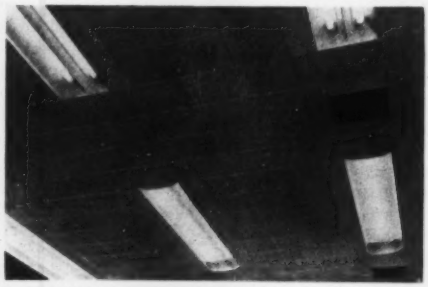

Fig. 5—Ceiling construction, Manufacturers Life Insurance Bldg., Toronto

Architects: Marani & Morris; Engineers: Charles S. Leopold, and Wiggs, Walford, Frost & Lindsay.

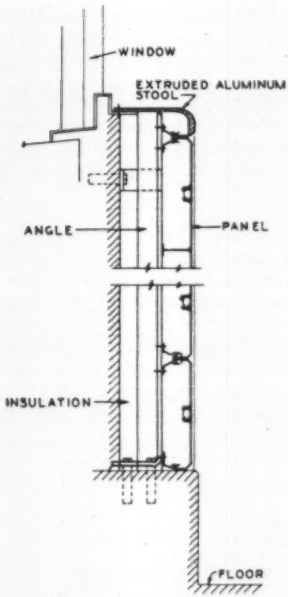

Fig. 6—Wall panel detail

radiation from a hot window or venetian blind.

Heating

In winter, the panels below the window can usually be the sole means of heating. Although the panels on the ceiling adjacent to windows can be used for heating, it is believed that optimum conditions are better obtained by providing a warm surface on the outside wall directly below the cold glass, where it serves both to offset the radiation and to minimize the flow of cold air down the glass. These panels have the additional advantage that during the night they are the only part of the system requiring operation to keep the temperature of the structure balanced, thus reducing the required period of operation of the entire system.

The foregoing description covers suggested uses of extruded aluminum panels. There are, obviously, many other ways of cooling a large surface by a tube carrying a coolant as, for example, by thermally bonding metal tubing to rolled panels of any material or, as previously noted, by imbedding the coolant tubes in a plaster ceiling or in the concrete of the construction. The selection of the type of ceiling and the area to be cooled would be determined by economics and the need for acoustic treatment.

Ventilation

For this discussion, forced ventilation has been assumed. Where it is desired to obtain relief, rather than controlled summer comfort, panel cooling can still be effective but the coolant temperature must be controlled to be above the dew point at all times. The conventional cooling means, with control, can be used or the coolant can be re-cooled by evaporation, thus insuring that the temperature at all times will be above the dew point. For controlled comfort cooling, air should be introduced in the amount and at a dew point to produce the necessary drying effect and ventilation and, since the dehumidification of the air is usually though not necessarily accomplished by refrigeration, the air may be economically used to produce a portion of the cooling effect. As previously pointed out[1], any thermal energy removed by the air has more than a proportional effect in reducing the required temperature difference between the room air and the panel, or in reducing the amount of panel required to remove the remaining sensible load.

Space Requirements

The reduction in required volume of air supply, whether it be delivered at high velocity or at more conventional velocity, results in a simplification of the air distributing problem, with lesser requirements for ceiling heights than conventional systems.

The design contemplated for a building which was to have 30-in. beams to span approximately 40 ft., is shown in Fig. 7. It was found that even with a building of large floor area, the largest hole required in the 30-in. beams, for horizontal distribution at low velocity, was 10 in. × 14 in. and the installation could, therefore, be made without

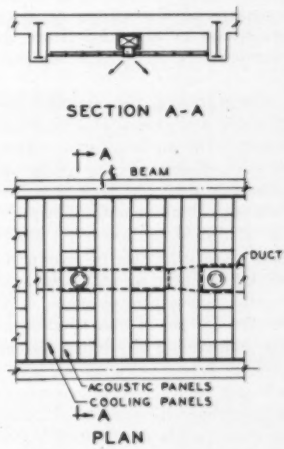

Fig. 7—Reflected ceiling plan

affecting ceiling height. The acoustic and panel ceiling could be kept above the lower edge of the fireproofed beam.

Panel cooling is well suited for buildings having large interior zones and may have special application in buildings which employ other methods but have separate areas of illumination requiring high energy levels.

The rentable area lost by air conditioning equipment is at a minimum because substantially the only floor space required outside of the apparatus room is that for the vertical trunk ducts when the major distribution is vertical. These ducts are inherently small because of the lower air quantity and may be designed for either commercial or for high velocity as the economics indicate. In general, the penalty incurred with high velocity in a trunk duct is very much less than in using high velocities in branch ducts.

The conservation of rentable area and the clear floor plan is the more apparent advantage of panel cooling. Its relative thermal stability is also significant and will be discussed.

Zone *vs.* Individual Control

As an end result, the purpose of comfort air conditioning is to adjust the thermal environment so that the occupants can work without being

conscious of discomforts or annoyances due to air temperature, humidity, odors, air motion, and radiation.

For a group, the optimum temperature and humidity is well established. For an individual, there is no such assurance. The group optimum is a statistical average and any individual may depart slightly from the statistical optimum. It follows that where a number of people must work together in an enclosure, a constantly maintained optimum is desirable. Means of individual control for maintaining a different temperature, as between two rooms, both of multiple occupancy, or two parts of a large room, is not required. If two or more people are constantly working in one room, they tend to require the statistical optimum and individual control is usually not required to maintain conditions other than the optimum. Depending on design, it may be required to maintain the selected optimum.

In a single occupancy private office, there may be a demand for separate temperature control, either because the occupant wishes a small adjustment representing his departure from the statistical average, or because he wants to feel cold or warm.

The purpose of this discussion is to show that there are two reasons for a multiplicity of controls or of control by small area. The first, if because of design it is necessary in order to maintain the selected optimum for the group; and the second, where it is desired to maintain a special condition for an individual which would not be acceptable to the group. Individual control is generally costly and can frequently be avoided by proper design and control of a zoned system. In this latter case, the determining factor is how well the system can meet different loads in adjacent areas of the same zone. If one room has more people and lights than an adjacent room with substantially the same air supply, how far will they differ in temperature? For years there have been installed zone systems in which air is introduced at from 12 to 25 deg below maintained room temperature. For two rooms side by side; one occupied—lights on, one unoccupied—lights off, there would be anticipated a marked difference in temperature. In fact, if no factors such as heat storage were taken into account, the one room could be assumed to differ from the other by the amount of the temperature difference of the air introduced and the general average of air temperature in that zone. Actually, it is found that these differences do not materialize to this degree. This helpful phenomenon has been accepted and assumed as a result of thermal storage but storage, until recently, was considered as being caused by the warm air heating the structure by convection. It is now known that this effect is greatly accelerated by radiation and that the structure is frequently warmer than the room air. An overloaded room, for example, does not get so warm as one would expect because radiation has accelerated the rate of storage.[1,3]

An approximation of these results by analogue is shown in Appendix B. In Fig. B-5 a comparison of Columns 1 and 3 and Columns 2 and 4 indicates that, in addition to the effect of radiation and convection on storage, the actual conduction through floor and ceiling is significant and that, as an end result, the variation between the underloaded and the overloaded room, with air introduced 26.3 deg below room temperature, is 9.7 deg (Column 4); whereas by conventional calculation without regard to storage, a 23.2 deg variation would be indicated. With air introduced 13.3 deg below room temperature, the deviation is 5.6 deg (Column 3) against a calculated 11.7 deg. The consideration of walls would further limit the deviation when factors of radiation, storage, and conduction are considered. These results explain the satisfactory behavior of well designed conventional zone systems and also show why poorly designed systems sometimes perform better than would be expected by conventional calculations.

Since a very narrow deviation of maintained temperature is acceptable, need for large air quantities and low temperature differences between the introduced and room air is still of importance for conventional systems. Unfortunately, large air quantities frequently result in the requirement for additional building areas or cube and, although this is seldom a determining factor in smaller buildings, it can be and often is of major significance in large buildings. This limitation is frequently not so serious in an existing building with higher ceilings than are customary in new construction.

The response of a panel cooling system to the same conditions of loading is shown in Fig. B-7. For the stated condition, the deviation between the overloaded and the underloaded room is 4.3 F as compared to 7.0 F with the conventional 13.3 T.D. system, as graphed in Column 1 of Fig. B-5. These results were obtained by simulating a completely rather than a partially paneled ceiling, and again do not take into account the effect of walls. In interpreting these results, consideration should be given to the following: They apply to an interior zone and to a load due principally to luminaires. In an office building, this is the preponderant load. For the solar load it was shown[3] that with a given masonry opening and for all types of glass, single and double, and for commonly used shading devices, room air temperature could be maintained by depressing the ceiling temperature by an amount varying from 12.1 to 9 deg, a difference of 3.1 deg.

The foregoing indicates a second advantage of panel cooling; namely, the possibility of maintaining close to the predetermined optimum with lesser need for individual controls than would usually be found in the ordinary well designed conventional zone system.

Individual controls can, if desired, be applied in the form of air volume, air temperature, or by control of water quantity or temperature to panels in a given area. Unless individual control is desired to take care of a single occupany office, the

air may be delivered at a predetermined constant temperature and the variations in load may be met by varying the water temperature to the panels by zones. There is considerable advantage in using constant temperature air supply to all zones of the building in that it avoids a multiple duct system with its complication of duct crossings. The trunk ducts become smaller in total area as higher velocities can be used in a larger duct at the same power expenditure. Constant quantity and temperature air delivery has proved satisfactory in an experimental installation over a three year period of operation.

Control in a Test Installation

Three rooms with a south exposure and one adjacent room in the interior, on the 32nd floor of a New York office building, were equipped with a test installation of panel cooling. The air supply to the south rooms was 0.5 cfm per square foot and to the interior room was 0.4 cfm. These air supplies were maintained at 60 F summer and winter, with a dew point at a maximum of 50 F. The conditioned space was completely surrounded by unconditioned space and a larger percent of the ceiling was in the form of panels than would be required in a completely conditioned building. Control of the panels was as follows:

The panels beneath the window sill were controlled by a thermocouple on the inside of the windowpane shielded from the direct rays of the sun by a metallic disc on the outside of the glass. This thermocouple regulated the supply water temperature for the panels below the windows. Since the major loss or gain of heat by transmission is through the glass, this device, to a large degree, integrated the effect of wind velocity, outside temperature, and, to some extent, the effect of the venetian blind. Thus, if the glass is at a temperature of 75 F, there is no need for either heating or cooling of the sill panel and this condition could prevail even on a cold winter day, if there is enough energy from the sun. The area of such panels is limited so that generally they cannot provide for the full solar effect.

The temperature of the water to the ceiling panels directly adjacent to the windows was controlled by the intensity of the sunlight as measured by a photo-electric device located outdoors. As the solar intensity increased, the water temperature was lowered. Photo-electric control, plus shielded outside dry bulb control, has proved satisfactory over a period of years for the primary control of air temperature to low pressure window units in a very large structure.

There was question as to whether the photo-electric device or an instrument similar to a pyroheliometer should be used. Tests with a heat meter and a light meter indicated that there was a straight-line correlation between total and visible radiation, with the exception of a few isolated deviations which were so few in number that the complications of maintenance of a pyroheliometer were considered unnecessary. The advantage of the photo-electric meter is that it is rugged, sensitive, commercially developed as a control means and, further, that dirt has little effect on its operation as it must be initially shielded with thick colored glass.

It will be noted that these controls respond to the outside conditions before they have had a chance to produce a measurable effect on the air temperature within the building.

The interior zone in the test installation was intended to be controlled by a time clock providing predetermined temperatures in accordance with a schedule. It was found, however, that one temperature of water was sufficient year-round. This installation differs from a fully air conditioned building in that the four rooms under test were surrounded by unconditioned space. Some elaboration of interior zone control is anticipated in a fully air conditioned building. The suggestion of a time clock to set a predetermined schedule of water temperature should be satisfactory, or it would be possible to control the temperature of the water to the interior zone panels from the changing electric power demand of that zone. In this way, the cooling effect would be applied as soon as there was load and would therefore anticipate and integrate the cooling requirements.

This control system recognizes that with a zone system there is little that can be done in sensing minor variations in load as between areas in the same zone and that the primary response of the system would, therefore, be better obtained by directly sensing the major load and making an allowance for the minor energy gains. The controls are applicable to zoned panel or air systems.

With conventional controls, it is customary to locate a thermostat either in an area considered to be average or in a return air duct. There are difficulties encountered with either of these procedures, though the method is useful. Instruments responsive to maintained air temperature all have the disadvantage of failing to call for a change until the room air temperature has been affected.

Comfort

The comfort results of a panel cooling system are comparable to the results which would be obtained with a good conventional zone system with relatively small difference between cooling air and maintained room air temperature and with air distribution as by a perforated ceiling.

In the test installation, there was no significant increase in the optimum room temperature in summer. The rooms were held at approximately 75 to 76 F. In winter, the people who lived with this test installation reported an apparent increased tolerance for lower temperatures than would normally be expected and this was partially substantiated by the fact that there was no comment when the temperature was deliberately varied from 75 to 70 F without the knowledge of the occupants. If the observation is correct, it may in part be explained by the following:

Temperatures are constant from the floor surface to within about 6 in. of the ceiling where a drop in temperature is noted. There is no noticeable air motion or draft, even at the floor. The sill panel provides symmetry of radiation. This reported result is the more unusual because the interior surfaces tend to be at a lower temperature than they would be with a conventional air system.

These opinions and observations are presented as a subject for further study. They cannot be considered as a definite conclusion drawn from a properly controlled test.

Limitations

There does not appear to be any problem in operating a panel cooling system with the lowest panel coolant temperature well above the desirable dew point for offices and similar structures but careful consideration must be given to applications in which it is possible for the dew point to rise above approximately 63 deg for a long enough period to produce condensation. Other than this problem of condensation, the limitations of a panel cooling system are those inherent in any system where there is a limited supply of

ventilation air and the sensible cooling is accomplished by multiple cooling units each serving a small area. In a liberally designed conventional air system, from two to four times as much air is circulated as with most split systems. Although the absolute quantity of outdoor air is no greater in a conventional system, the total supply to any one office, including recirculated air from other areas, can be considered as substantially smoke-free when compared with the air in a room in which people are smoking, so that the control of concentrated sources of odor is not so good as it would be for a comparable conventional system.

The other limitation of split systems in general lies in the fact that refrigeration, rather than outdoor air, is required for more hours than would be needed for a liberally designed all air system. This effect may, in part, be offset by the relatively small power requirements of the panel system. In cool weather, with panel design, the incoming outdoor air can be caused to cool water to be circulated in the panels and, since the total air circulated may be greater than the minimum outdoor air requirements for peak summer weather, some extension to the hours of cooling without refrigeration may be obtained.

In applying conditioning to large buildings, there are frequently special areas which can be best served with a conventional system and, if there is a series water circuit, the outdoor air passing through these conditioners can also be caused to cool the panel water. Evaporative cooling may be used to cool the water which is circulated to the panels. In a panel system, the problem is generally easier than with coil systems since the panels will seldom require water below 65 F. With the panels, there is the further possibility of operating two levels of refrigeration, one for panel cooling and the other for dehumidification.

Conclusion

The author has attempted to present the theory of panel and conventional air cooling systems and to indicate possible courses of panel cooling design.

In comparing air conditioning methods, it is essential that the methods under comparison shall not produce an end result which will unduly compromise with the production of optimum conditions.

Assuming that the air conditioning methods to be compared are capable of attaining the same end result, the selection of a particular form of air conditioning is a matter of economics. The air conditioning design should be related to all elements of building construction and use, and the economics be determined not solely on the owning and operating cost of the air conditioning but on the owning and operating cost of the entire building.

Acknowledgment

The author wishes to express his appreciation to The Bohn Aluminum & Brass Corp. for its cooperation in the commercial development of the panel; to *Time*, *Life*, *Fortune* and *Architectural Forum*, who financed the laboratory work; and to Frank Wilder, who had charge of the experimental program for the author.

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APPENDIX A

Cooling Panel Performance with Load Due to Luminaires

Part Ceiling—Steady State

The test cubicle previously described[1] was modified by the addition of a suspended ceiling 9 in. below the continuous cooling panels, as shown in Fig. A-1. The supply air grille was lowered to maintain 12 in. from the top of the grille to the under side of the suspended ceiling. Standard perforated steel pans with acoustic pads covered 71 percent of the ceiling, and 29 percent was in the form of aluminum panels of the same construction as those used in previous tests. These panels were 6 ft 8 in. long, 2 ft wide, and were separated by 2 ft of the perforated steel ceiling pans. A 1 in. layer of insulation board was placed on the under side of the original continuous ceiling cooling panels. During this series of tests the original ceiling panel was maintained at the same temperature as the surface of the insulated floor and, since the 1 in. of insulation board has approximately the same thermal

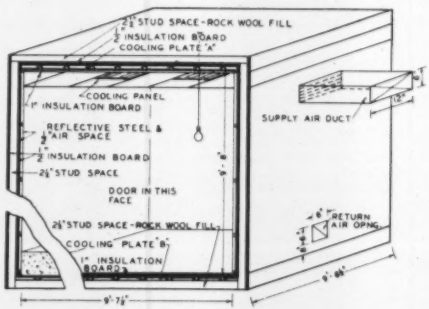

Fig. A-1—Construction of test room for luminaires

Table A-1—Summary Part Ceiling—Steady State
(Air Supply Where Used, 37.4 cfm—Floor Area, 92 sq ft)

Lamp Type	Air Supply Temp. F	Paint Used on Panels[a]	Panel Transfer[b] Btu/(sq ft) (hr)	Panel Transfer[b] % of Lamp load	Panel Temp[c] F	Air Temp[d] 5' ft Level F	Floor Temp[c] F	Air Temp 2½ in Below Panel Center[c] F	Air Temp 4 in. Above Panel Center F	Structure Temp Directly Above Panel Center[c] F	Apparent "h" For Panel Btu/(sq ft) (hr) (F deg)
500 w, Bowl Silver Indirect	No Air	#1	51.2	80.0	61.6	78.0	79.5	77.6	72.9	71.7	3.12
500 w, Bowl Silver Indirect	60	#1	28.3	44.0	69.4	"	79.2	77.5	74.0	73.8	3.29
500 w, Bowl Silver Indirect	No Air	#2	51.2	80.0	62.2	"	78.6	78.3	74.6	73.0	3.25
500 w, Bowl Silver Indirect	60	#2	34.7	54.1	69.9	"	79.3	77.8	75.4	74.8	4.29
500 w, Bare	No Air	#1	46.4	72.5	61.6	"	79.4	78.0	71.6	70.1	2.83
500 w, Bare	60	#1	26.3	41.0	69.5	"	81.0	78.3	75.5	74.3	3.10
500 w, Bare	No Air	#2	48.2	75.1	61.1	"	79.5	77.4	72.4	71.1	2.86
500 w, Bare	60	#2	33.0	51.4	68.5	"	80.4	77.6	74.2	73.9	3.47
300 w, Bowl Silver Indirect	No Air	#1	28.6	74.6	68.6	"	78.7	78.0	75.3	74.6	3.04
300 w, Bare	No Air	#1	27.2	71.0	67.8	"	79.2	77.7	74.0	73.8	2.67
6 Single-Tube Direct Fluorescent	No Air	#1	41.3	92.0	61.7	"	78.3	79.0	72.1	70.9	2.54
6 Single-Tube Direct Fluorescent	60	#1	18.1	40.4	71.1	"	79.2	78.5	75.1	75.0	2.62
2 Four-Tube Semi-Direct Flourescent	No Air	#1	40.7	83.5	63.9	"	76.8	79.8	74.2	72.3	2.89
2 Four-Tube Semi-Direct Flourescent	60	#1	19.8	40.6	71.9	"	78.6	79.5	75.8	75.5	3.24

[a]#1 Zinc oxide flat white paint. #2 Special copper phosphate heat absorbing paint.
[b]Measured by water flow and temperature rise.
[c]By surface couples.
[d]Aspirated couple.
[e]Corrected for Radiation.

resistance as 10 in. of cinder concrete, this procedure approximated the steady state condition in the interior zone of a multi-story building with 10 in. cinder concrete slab construction.

As in previous experiments, two types of ceiling paint were used, a commercial flat white paint containing zinc oxide and a special paint containing a small amount of copper phosphate.[8] Test data are presented in Table A-1.

The unit area performance of a cooling panel which comprises only a portion of a suspended ceiling is usually greater than the unit area performance of a panel in a continuously cooled ceiling, due in part to the effectiveness of the top of the panel as a useful heat sink and, to some extent, to conduction from the adjacent metal acoustic pans.

There are combinations of air supply, type of luminaire, and ceiling paint which will cause a continuous ceiling to be more effective per unit area than a partially paneled ceiling.

The tables include a column for the fictitious value of surface conduction h. This factor is presented as a convenience only. As previously pointed out[1] it is not correct to present these results in the form of overall surface coefficients to cover both radiation and convection since they cannot be multiplied by a temperature difference as, for example, panel to room air, to predict results under any other conditions than those of this particular test.

The column on Independent Radiant Transfer shown in the previous experiments is omitted here as tests were not conducted for the separate measurement of this quantity.

Part Ceiling — Unsteady State

Tests were performed to check the effect of thermal storage with a panel cooling system for the load due to luminaires. In the test cubicle with a part panel ceiling, the 1 in. insulation board covering the floor panel was removed and 10 in. cinder concrete slab was poured directly on the panel (lower left corner Fig. A-1) in the following mixes:

5-½ in. of 1:2:5
3-½ in. of 1:3:6
1 in. of 1:2

¼ in. thick dark red asphalt tile was placed on top of the concrete. Thermocouples were inserted in the concrete slab. The original hung lighting fixtures were replaced by two prismatic glass reflectors; one to direct light to the ceiling panel, the other to the floor. This arrangement was used to minimize the absorption effect of radiant energy by the insulated and reflective walls.

The water temperature to the floor panel beneath the concrete was maintained constant at its initial value before the start of the test. The full panel ceiling water temperature was regulated throughout the test according to the surface temperature of the floor. The part panel temperature was set at an initial depression below the room air temperature and maintained constant throughout the test. The air supply to the room was 0.4 cfm/sq ft and maintained at a constant temperature.

A lighting load of 500 watts was selected as the standard loading (5.4 watts per square foot) and, with the required panel depression to maintain the room air constant at its initial value with this loading, additional tests were conducted with the room 160 percent (800 watts) and 60 percent (300 watts) loaded. The effect of using a higher supply air temperature with the normal loading was checked by one test. All tests were conducted with

Table A-2—Summary, Part Ceiling—Unsteady State
(Air Supply Where Used, 37.4 cfm—Floor Area, 92 sq ft)

Test No.	Lamp Arrangement	Air Supply F	Paint used on Panels[a]	Panel Transfer[b,c] Btu/(sq ft) (hr)	Panel Transfer[b,c] % of Lamp Load	Panel Temp[c,e] F	Air Temp.—5' Level[d] Initial	Air Temp.—5' Level[d] 3rd Hr	Air Temp.—5' Level[d] 5th Hr	Floor Surface Temp[c,e] F	Air Temp 4 in. Above Panel Center[e] F	Structure Temp Above Panel Center[e] F	% Storage of Lamp Load At End Of 3rd Hr	% Storage of Lamp Load At End Of 5th Hr	Apparent "h" For Panel[e] Btu/(sq ft) (hr) (F deg)
1	200 w Up — 300 w Down	60.0	#2	29.2	45.5	69.0	78.0	77.8	78.0	79.5	74.5	74.3	15.0	14.9	3.25
2	300 w Up — 500 w Down	60.0	#2	40.5	39.4	70.5	78.0	81.9	82.4	82.7	75.4	75.1	18.1	19.1	3.40
3	100 w Up — 200 w Down	60.5	#2	21.6	56.5	69.0	78.0	76.2	76.2	77.8	73.8	73.5	2.8	5.0	3.00
4	200 w Up — 300 w Down	70.0	#2	35.0	54.5	69.5	78.0	80.0	80.5	80.6	74.8	72.6	21.3	27.9	3.18

[a]#2. Special copper phosphate heat absorbing paint.
[b]Measured by water flow and temperature rise.
[c]By surface couple.
[d]Aspirated couple.
[e]Fifth hour value.
[f]For conditions of test only.

heat-absorbing paint on the ceiling. Tests are summarized in Table A-2. Figs. A-2 and A-3 show the variation of structure and air temperatures with time for the normally loaded room.

In Test No. 1 for the normally loaded room, the panel temperature was initially established and continuously held at a value which would produce a 78 F room air temperature at the end of five hours. For Tests Nos. 2 and 3 this same panel temperature was maintained in order to check the deviations of room air and structure with time under different conditions of load. This variation in temperature of 6.2 F compares with the approximately 4.3 F deg variation for a continuously cooled ceiling, as shown in Fig. B-7.

In the overloaded room, with a panel ceiling, the rise in structure temperature is less than for a conventional air system. Floor, ceiling, and mean radiant temperatures are lowered.

Test No. 4 is for the same conditions as Test No. 1 but with the air introduced at 70 F instead of 60 F.

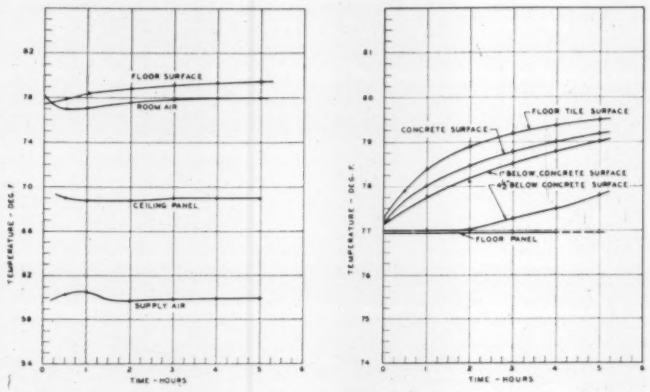

Fig. A-2(*left*)—Test data for the normally loaded room, unsteady state. Fig. A-3 (*right*)—Test data, normally loaded room, unsteady state, temperature within the structure

Table A-3—Solar Model Part Panel Ceiling
(Data for End of 3rd Hour)

Tests[a]	Single Clear Glass Inside White Ven. Blind	Heat Absorb'g Glass Outside, Clear Glass Inside, White Ven. Blind	Double Clear Glass, White Ven. Blind Between Glass Panes	Double Clear Glass, ¼ Drawn Inside White Ven. Blind	Double Clear Glass, White Shade Between Glass Panes	Single Clear Glass Inside White Ven. Blind	Single Clear Glass Inside White Ven. Blind
	A	B	C	D	E	F	G
1. Ceiling Paint	Regular	Regular	Regular	Regular	Regular	Heat Absorb'g.	Heat Absorb'g.
2. Room Air Temperature (aspirated) F	78.0	78.0	78.0	78.0	78.0	78.0	78.0
3. Average Ceiling Panel Surface Temperature F	65.5	69.0	68.2	68.1	70.5	67.9	72.3
4. Average Sill Panel Surface Temperature F	66.1	69.2	68.4	68.0	71.0	68.1	72.5
5. Supply Air Temperature F	57.2	61.6	62.1	58.9	63.9	59.9	61.9
6. Return Air Temperature F	76.6	77.3	77.7	77.5	77.8	76.4	76.9
7. Floor Surface Temperature F	75.6	78.1	78.9	77.3	78.9	74.4	76.3
8. Rear Wall Surface Temperature F	79.2	78.9	80.0	79.9	80.9	79.0	78.9
9. Alzac Surface Temperature F	78.7	78.3	79.3	78.7	78.5	78.0	77.7
10. Wall Surface Temperature Above Window F	85.7	86.1	81.8	84.5	86.5	85.4	86.9
11. Shield Thermocouple (room air) F	78.3	78.2	78.2	78.7	78.1	78.4	78.1
12. Inside Shade or Venetian Temperature F	89.7	84.3	127.0	94.5	113.9	92.4	89.3
13. Inside Glass Temperature F	114.4	114.1	103.4	97.0	95.4	—	—
14. Outside Glass Temperature F	114.7	134.8	131.0	104.5	113.9	101.4	101.1
15. Front Ambient Temperature F	79.7	83.8	89.0	83.5	85.9	78.4	84.6
16. Ceiling Panel Transfer by Test Btu/hr.	102.0	76.0	80.8	93.0	72.0	107.0	58.0
17. Sill Panel Transfer by Test Btu/hr.	47.8	36.3	44.0	60.8	40.2	44.0	28.6
18. Removal by Air Supply Btu/hr.	65.5	53.1	53.0	63.0	47.0	55.8	50.7
19. Transfer Through Walls[b] Btu/hr.	— 42.1	— 8.7	26.4	— 30.8	— 4.8	— 33.0	— 28.7
20. Storage (average)[c] Btu/hr.	5.0	— 9.0	— 6.0	35.0	1.0	9.0	9.0
21. Total Room Load[d] Btu/hr.	262.4	165.1	145.4	282.6	165.0	248.8	175.0
22. Normal Incident (meter) Btu/hr.	536	463	509	515	498	490	343
23. Reflection, % of Normal Incident (meter)	35	12	38	—	42	36	37
24. Solar Altitude Deg.	35	35	35	35	35	35	60
25. Solar Azimuth Deg.	0	0	0	0	0	0	0
26. Room Load from Test, % of Normal Incident	49.0	35.6	28.6	55.0	33.1	50.8	51.0
27. Apparent "h" for Ceiling Panel Btu/(sq ft) (hr) (F deg)	3.26	3.38	3.30	3.75	3.83	4.22	4.07
28. Apparent "h" for Sill Panel Btu/(sq ft) (hr) (F deg)	2.14	2.19	2.43	3.22	3.05	2.36	2.75
29. Calc. Room Load, % of Normal Incident 78 F Ambient (5 mph Wind)	46.7	30.2	24.8	51.9	30.0	48.8	46.6
30. Calc. Room Load, % of Normal Incident 93 F Ambient (5 mph Wind)	50.6	33.1	27.5	57.5	33.0	52.8	52.7

[a]Window fully covered where shading devices used except where noted, venetian blind slats set at 55 deg.
[b]Positive values — transfer into room.
[c]Positive values — increased storage.
[d]Values of line 21 = values of lines [(16 + 17 + 18 + 20) — 19].
Ceiling panel area — 2.50 sq ft. Sill panel area — 1.88 sq ft. Floor area — 6.25 sq ft.

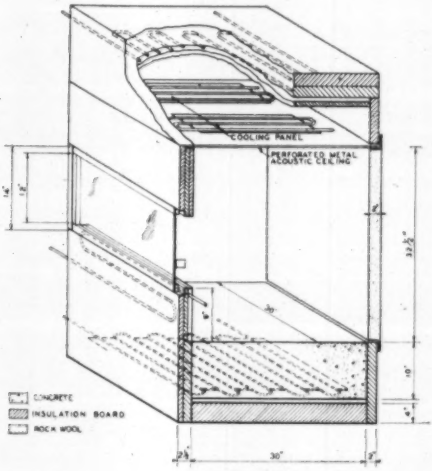

Fig. A-4—Construction of model for solar test

Cooling Panel Performance with Load Due to Solar Radiation

Part Ceiling

The original experiments[3] are here extended to include data on a suspended ceiling consisting, in part, of panels. Data were obtained for additional types of shading device and angles of incidence other than 35 deg.

The solar model previously described was modified by the addition of a suspended ceiling of which 40 percent was in the form of aluminum panels and 60 percent of steel perforated plate with acoustic pads above, as shown in Fig. A-4. The panels were 20 in. long by 9 in. wide and separated by 6 in. of perforated steel ceiling. The original continuous panel ceiling was raised 9 in. and covered with 1 in. of insulating board on the under side to represent the thermal resistance of a concrete slab of the floor above in a multi-story building. The openings created by the raising of this panel were sealed with insulating board to conform with the original walls of the model. The water piping arrangement remained as previously described. Additional piping was installed for the new ceiling. For these tests the continuous ceiling panel temperature was adjusted to be the same as the surface temperature of the floor in order to simulate the steady state condition. Other than for this point, the procedure was the same as in the original test with a continuous ceiling[3].

The test data are presented in Table A-3. The performance per unit area, where the panel represents 40 percent of the ceiling, is better than the performance for the continuously cooled ceiling, as previously presented[3]. Lines 27 and 28 have been included for convenient comparison. Line 20, heat storage within the floor, is small with the exception of the one test with a half-drawn blind, in which case the radiant energy from the artificial sun was permitted to strike the floor.

Columns B, C and E indicate that the scheme of placing a venetian blind or white shade between two sash is approximately equivalent to using heat absorbing glass outside, clear glass inside, plus a white venetian blind. Both methods effect a significant decrease in the solar heat load.

APPENDIX B

Space Cooling Systems Analyzed With a Hydraulic Analogue

In a previous paper[3] the difference between the real behavior of a conventional air cooling system and the design concept is indicated by means of a hydraulic analogue. These studies have been continued with the analogue modified as required.

Fig. B-1 indicates the performance of a conventional air cooling system for the interior zone of a multi-story building, with eleven hours of operation of the system and nine hours full load due to the lighting system. The illumination in this case has been assumed as by direct filament lamps and a load equivalent of 2.7 watts per square foot. At the end of the third day the actual cooling requirements are approximately 83 percent of that calculated for the removal of the internal sensible load.

Fig. B-2 approximates the performance

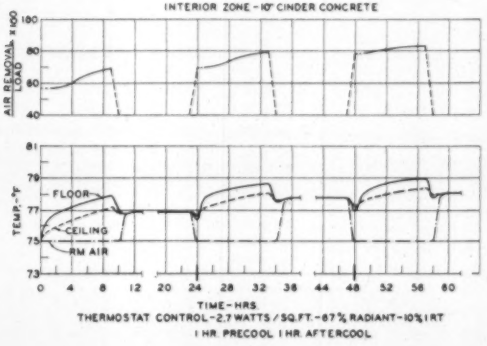
INTERIOR ZONE - 10" CINDER CONCRETE
AIR REMOVAL LOAD x 100
TEMP. - °F
FLOOR
CEILING
RM AIR
TIME - HRS.
THERMOSTAT CONTROL - 2.7 WATTS / SQ.FT. - 67% RADIANT - 10% I.R.T.
1 HR. PRECOOL 1 HR. AFTERCOOL

Fig. B-1—Performance of an air cooling system with direct lighting by filament lamps

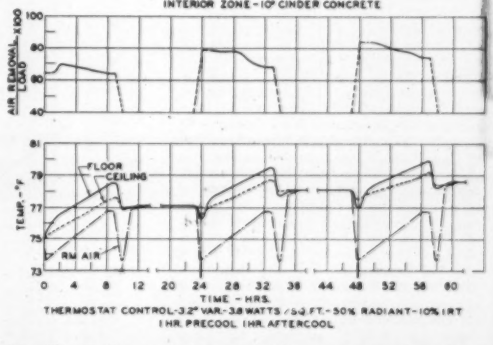
INTERIOR ZONE - 10" CINDER CONCRETE
AIR REMOVAL LOAD x 100
TEMP. - °F
FLOOR
CEILING
RM AIR
TIME - HRS.
THERMOSTAT CONTROL - 3.2 WATTS / SQ.FT. - 50% RADIANT - 10% I.R.T.
1 HR. PRECOOL 1 HR. AFTERCOOL

Fig. B-2—Performance of an air cooling system assuming a lower percentage of heat gain in the form of high temperature radiation as would be approximated by direct filament lighting and people

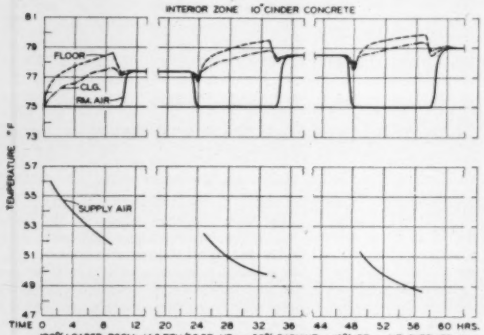
INTERIOR ZONE 10" CINDER CONCRETE
FLOOR
CLG.
RM. AIR
SUPPLY AIR
TEMPERATURE °F
TIME 0 4 8 12 20 24 28 32 36 44 48 52 56 60 HRS.
100% LOADED ROOM = 14.9 BTU/SQ.FT.-HR. — 50% RADIANT — 10% IRT — AIR SUPPLIED IN QUANTITY AND TEMP. TO MAINTAIN ROOM AT 75° — SAME LOADING ABOVE AND BELOW. 1-HR. AFTER-COOLING — 1-HR. PRE-COOLING 2ND & 3RD DAY

Fig. B-3—Air cooling systems—required supply air temperature *vs.* time to maintain constant temperature

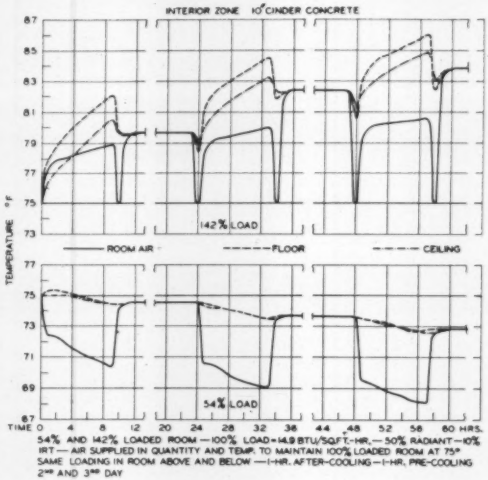
INTERIOR ZONE 10" CINDER CONCRETE
142% LOAD
54% LOAD
ROOM AIR
FLOOR
CEILING
TEMPERATURE °F
TIME 0 4 8 12 20 24 28 32 36 44 48 52 56 60 HRS.
54% AND 142% LOADED ROOM — 100% LOAD = 14.9 BTU/SQ.FT.-HR. — 50% RADIANT — 10% IRT — AIR SUPPLIED IN QUANTITY AND TEMP. TO MAINTAIN 100% LOADED ROOM AT 75° SAME LOADING IN ROOM ABOVE AND BELOW — 1-HR. AFTER-COOLING — 1-HR. PRE-COOLING 2ND AND 3RD DAY

Fig. B-4—Air cooling systems—temperature for a structure and air for a 54 percent and a 142 percent loaded room with air supply for a normally loaded room

of a conventional system, with 3.8 watts per square foot, assuming a luminaire having a lesser radiant component than a filament lamp, or a rough approximation of a load consisting of filament lamps and people. In this experiment the room air has been assumed to be permitted to vary from 73.6 F to 76.8 F. The actual sensible cooling requirements in the afternoon are indicated as less than in the morning and this is a fair indication of the performance of a system which is under capacity as to means of sensible heat removal.

In order to establish some boundaries to the problem of the need for individual control for differently loaded rooms on the same zone of a conventional system, the problem was set up on the Analogue as follows:

In Fig. B-3 the supply air temperature to maintain constant room temperature was determined for a three-day period. At the end of the third day, the required air temperature was approximately 49 F to maintain 75 F, and this difference of 26 deg was assumed as establishing the design temperature difference between room air and air introduced for cooling. As shown in Fig. B-1, the full cooling effect of design air is not required at the end of the third day so that this temperature depression of supply air would correspond to a slightly greater depression in conventional design. The air temperature schedule diagrammed in Fig. B-3 was then applied on the Analogue to a room which had 142 percent of full load and to a room having 54 percent of full load. The temperature results of structure and air are diagrammed in Fig. B-4.

For the result in B-4 it was assumed that the space directly above and directly below were subject to the same overload and the same underload as the area stated. The experiment on the Analogue was repeated but modified in the assumption that the rooms directly above and directly below were maintained at normal load. This condition was simulated by maintaining a known schedule of mid-point temperatures, floor and ceiling slab, as previously determined as an average for a run with a normally loaded room and a run for an overloaded or underloaded room. This is not an absolute parallel but the assumption is within the accuracy of the experiment.

The results of the two series of experiments are shown in Fig. B-5, for two depressions of air supply below room temperature as measured at the end of the third day.

Comparison of Columns 1 and 3, 4 and 5, shows the importance of transmission through the floor and ceiling slabs. Trans-

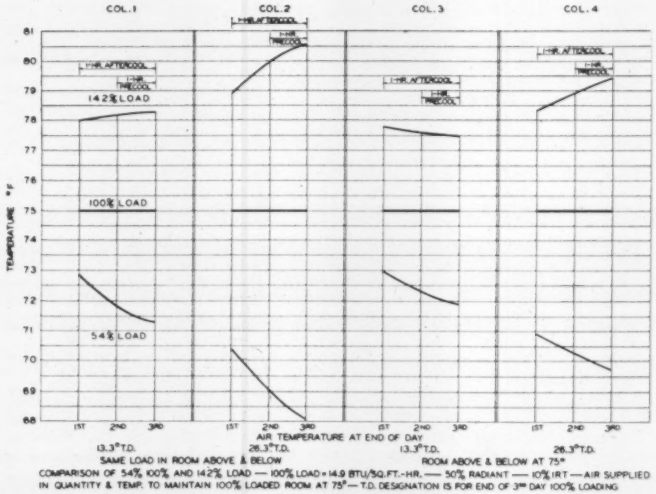
COL. 1
COL. 2
COL. 3
COL. 4
1-HR. AFTER-COOL
1-HR. PRE-COOL
142% LOAD
100% LOAD
54% LOAD
TEMPERATURE °F
1ST 2ND 3RD
13.3° T.D.
26.3° T.D.
AIR TEMPERATURE AT END OF DAY
SAME LOAD IN ROOM ABOVE & BELOW
ROOM ABOVE & BELOW AT 75°
COMPARISON OF 54%, 100% AND 142% LOAD — 100% LOAD = 14.9 BTU/SQ.FT.-HR. — 50% RADIANT — 10% IRT — AIR SUPPLIED IN QUANTITY & TEMP. TO MAINTAIN 100% LOADED ROOM AT 75° — T.D. DESIGNATION IS FOR END OF 3RD DAY 100% LOADING

Fig. B-5—Air cooling systems—results of tests of required room air temperature at the end of day when supply air is introduced to maintain the 100 percent loaded room air temperature at 75 F during each day

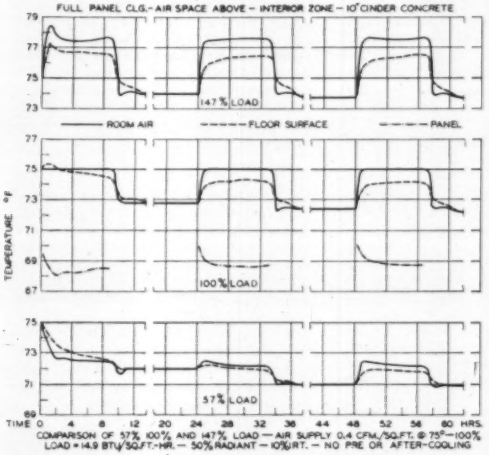
FULL PANEL CLG.-AIR SPACE ABOVE — INTERIOR ZONE — 10" CINDER CONCRETE
147% LOAD
ROOM AIR
FLOOR SURFACE
PANEL
TEMPERATURE °F
100% LOAD
57% LOAD
TIME 0 4 8 12 20 24 28 32 36 44 48 52 56 60 HRS.
COMPARISON OF 57% 100% AND 147% LOAD — AIR SUPPLY 0.4 CFM/SQ.FT. @ 75°—100% LOAD = 14.9 BTU/SQ.FT.-HR. — 50% RADIANT — 10% IRT. — NO PRE OR AFTER-COOLING

Fig. B-6—Room air and floor surface temperatures for a panel cooling system in which the panel is the only means of cooling. The panel temperature required to maintain the 100 percent loaded room air temperature at 75 F is used in the overloaded and underloaded rooms

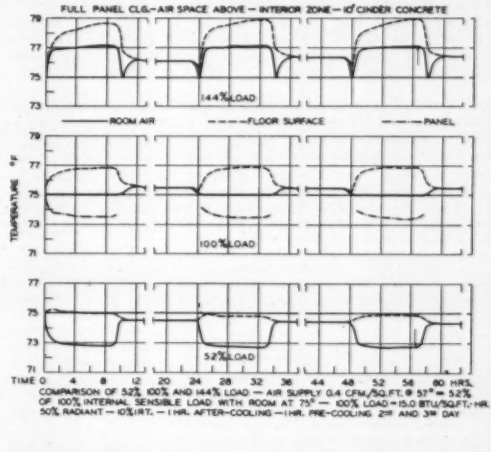
FULL PANEL CLG.-AIR SPACE ABOVE — INTERIOR ZONE — 10" CINDER CONCRETE
144% LOAD
ROOM AIR
FLOOR SURFACE
PANEL
TEMPERATURE °F
100% LOAD
52% LOAD
TIME 0 4 8 12 20 24 28 32 36 44 48 52 56 60 HRS.
COMPARISON OF 52% 100% AND 144% LOAD — AIR SUPPLY 0.4 CFM/SQ.FT. @ 52° = 52% OF 100% INTERNAL SENSIBLE LOAD WITH ROOM AT 75° — 100% LOAD = 15.0 BTU/SQ.FT.-HR. 50% RADIANT — 10% IRT. — 1 HR. AFTER-COOLING — 1 HR. PRE-COOLING 2ND AND 3RD DAY

Fig. B-7—Resultant room air and floor surface temperatures for a panel cooling system in which both supply air and panel provide room cooling

mission through partition walls would be expected to have a similar effect.

The Analogue was modified to simulate a continuous suspended panel ceiling. Briefly, this is accomplished as follows:

The Independent Radiant Transfer is independent of the panel temperature. The effect of the Independent Radiant Transfer could, therefore, be simulated by not introducing into the system the quantity of fluid corresponding to this energy. A single tube, corresponding to the thermal capacity of an aluminum ceiling with coolant tubes, was used to simulate the panel. This tube was then connected to suitable conductors representing radiation to the floor and ceiling above and other conductors representing convection to the air below and above the panel. The temperature of the panel was simulated by a valve connection which controlled the height of liquid in the tube to simulate the panel temperature.

The Analogue was operated to establish the required panel temperature for the normally loaded room, with a selected air supply of 0.4 cfm at room temperature, as shown in the middle diagram of Fig. B-6. This schedule of panel temperatures was then applied to the overloaded and underloaded room, as shown in the upper and lower diagrams respectively. The experiment was repeated with the modification that the ventilating air was assumed as introduced 18 deg below the temperature of the normally loaded room, with the results as shown in Fig. B-7. Where the full ceiling is used in this latter case, the required panel depression below room air temperature is less than 2 deg.

Discussion

F. W. Hutchinson, Berkeley, Calif.: In my opinion, the idea behind this paper is the greatest in applied radiation for the last 10 years.

Edward Simons, San Francisco, Calif.: It has been my pleasure to follow Mr. Leopold's development since 1947. Those wishing to study the subject will want to follow the papers mentioned in the Bibliography.

Since 1947, Mr. Leopold has gone into a very thorough study of conductance, with respect to both convection radiation and conduction. He separated them into wall, ceiling and panel surfaces, as he had to establish values for each. Subsequently, he adopted the term *IRT*, which was the independent radiant transfer to the ceiling panel, exclusive of that which was absorbed by other parts of the room. It was an important breakdown. He also began to develop the conductances to these surfaces, later applied to his analogue.

I would suggest, however, that the Appendix be extended to include the diagram of the analogue, and also that the tube representing the panel and its temperature and the conductances into the ceiling be shown. This will be useful information for those who want to follow the explanation. This is another important paper on the subject; and Figs. B-3, B-4 and B-7 are valuable in showing comparisons in a room supplied with convection cooling as compared to a room supplied with air at a fixed temperature and quantity, and using fixed panel temperature.

If we may take a certain level of mean radiant temperature vs. ambient temperature as a measure of comfort, setting that as a comfort equation, and then assume the average surface temperature as being equivalent to the mean radiant for our particular discussion, we will arrive at these findings: In Fig. B-7, for cooling panel (a normally loaded room) the average temperature of the ceiling and floor, plus that of the air, equals about 150 deg. In the normally loaded room, Fig. B-3, under the conduction and convection cooling (the normal type), it is found that the average temperature of the air is 75 F, but this rises to about 79½ as the average temperature of ceiling and floor rises. This is a departure from that basis of the set figure of 4½ deg. If we take the overloaded rooms with the panels, Fig. B-7, it is found that this type of departure, with fixed air supply and fixed panel, is only about 3.1 F, a lesser departure than for the normal type of room. The underloaded panel room has only a depression below that of normal of about

3.1 F. However, on the overloaded room with air cooling only, the result is a departure of 16 deg in the plus direction, and nine in the minus direction on the underloaded room.

Therefore, with this type of a system, and with our analysis as the basis of this analogue and thinking, it is seen that a definite approach is being made to a steady energy device with which we can begin to apply general energy equations regarding what enters and what emerges.

I know that the time is limited and I am going to say no more, except that I think this is estimable work.

G. LORNE WIGGS, Montreal, Que., Canada: I would like to congratulate Mr. Leopold on his excellent paper. It should be thought-provoking for many of our members.

The author has referred to this system as a panel and air cooling system. This is probably better than simply a radiant cooling system. On the other hand, if the term *radiant heating system* can be applied to a system heating predominantly by radiation, then, probably, the expression *radiant cooling system* is a satisfactory name for this type of cooling. In England, such a system would be referred to as a panel warming and cooling system, with moderate air conditioning.

I would like to point out that panel cooling is not new, as you might think. It was conceived and developed by Richard Crittall & Co., Ltd., England. Apart from the experimental installations they made, it was first installed by them in the Imperial Chemical House, London, in 1935. That system has, I think, about 900 tons of refrigeration to cool the water and air, giving you an idea of the size of the system. It has also been installed in many other buildings in Europe, but it has not been used here on this continent, except for the installation mentioned by Mr. Leopold.

As far as I can determine, there is no real scientific basis for the designs that were made in England and Europe. Consequently, this paper is probably the first publication that would permit design with a little more confidence than is possible with the rules of thumb used in Europe.

To give you some idea of this, the Manufacturers Life Building installation will contain about 240,000 sq ft of floor area. It is located in a climate with a maximum temperature reaching almost as high as that of Philadelphia, but whose duration of high summer temperature is not nearly as long. Winter temperatures there, on occasions, drop to about 25 deg below zero. As a result, air conditioning systems must be capable of operating satisfactorily over a wide range in climatic conditions.

In the Manufacturers Life Building, on a typical floor, about 12 percent of the ceiling area is taken by the peripheral panels; 1 percent of the ceiling is occupied by the diffusers; about 22 percent by the luminaires; and the remaining 65 percent consists of perforated steel acoustic panels which, with the high noise reduction coefficient of those panels, will give a satisfactory acoustic treatment.

In the Canadian installation, Canadian-made extrusions are used. These differ in some details from those described by the author of this paper. They are actually 0.080 in. thick. Admittedly, this requires more aluminum, but the difficulty of extruding them is less, so that the manufacturers are delivering at a somewhat lower price than that at which they would have provided the thinner panels.

In Norway they have been developing and using perforated aluminum panels of sheet aluminum rather than extrusions. The entire ceiling is covered with aluminum panels fastened to pipes through heat-conducting clips. Warm water is circulated through the pipes in winter, and chilled water in the summer. Thus, heating or cooling is obtained as required. The pipes themselves serve as supports for the panels. It is probably true that this system may be less expensive than the extruded panel type in many cases.

In closing, I would just like to say that this system shows great potential, particularly in such areas as operating rooms, where drafts are sometimes serious. In addition, with television cameras being used in operating rooms for instruction purposes, methods for removing heat, without increasing air quantities, can be tremendously important. The system also can be used to great advantage in textile mills and other places where there are large concentrated loads, as well as considerable noise.

A. T. JORN, Libertyville, Ill.: This is a fine paper in that it has covered the radiant panel for cooling in regard to its limitations, its attributes, its physical constructions, its integration with other functional units, and its probable relationship to conventional air conditioning. Industry, and in particular research men, appreciate consulting engineers who are enthusiastic about new tools for providing human comfort, and who investigate for themselves the best means for applying research developments and inventions. Such enthusiasm expedites the moving of new concepts from the laboratory and field-trial stage into widespread public use.

This is also one of the first technical papers to call wide attention to the new radiant metal panels and to present some of the research work which has been quietly carried out with them in various points about the country. This paper gives such a broad perspective to anyone interested in the application of metal radiant panels for cooling, that I would like to add some information on work done in my particular research and development group.

Mr. Leopold has pointed out several ways of applying cooling panels: (1) as panels, essentially at room temperature, grouped around windows to absorb solar radiation; (2) as panels (or luminaires), essentially at room temperature, strategically placed about the ceiling area to absorb the heat emitted by the illumination units; and (3) as panels, essentially below room temperature, installed to cover the entire ceiling area for removing all or any apportioned part of the sensible heat caused by solar radiation, artificial illumination, electrical equipment, and human occupancy.

The third application of the panels was not discussed at length by the author. Its limitations were due to (1) relatively high cost of cooling panels; (2) mutually eliminating characteristics of acoustic panels and radiant panels; (3) problems involving symmetry of appearances of the completed ceiling; and (4) possible condensation problems if panel temperatures were lowered sufficiently to be useful in absorbing heat other than high temperature radiation.

It is upon this third method of using cooling panels and the associated problems that I should like to comment:

1. Most types of metal radiant panels as mentioned in the paper tend to be expensive, since the coolant carrying coil is attached to the radiating surface in an expensive manner, either by brazing or by expansion into a pre-formed groove. The metal surface is composed of relatively thick material according to the manufacturing processes; the coil must be of expensive material also due to manufacturing processes; and installation of the finished panel is a relatively slow and awkward process.

The cost consideration can be reduced appreciably by a design in which the radiating surface can be rapidly attached to the coil after installation by means of integral clamps which make a good and uniform thermal contact. The panel is made of a minimum thickness of material consistent with structural strength (about 1/5 to 1/2 that required in some metal radiant panels). The panel material is that which is most economical for the required thermal capacity. Steel and copper, as well as aluminum of maximum thermal conductivity, have economic application. The coil may be of any standard coil material.

2. Conflict between radiant and acoustical panels can be eliminated by perforating the panels, as pointed out in the paper. The design just mentioned would not interfere with the all-over, approximately 10 percent open, perforation pattern generally used on acoustic ceilings. The only purpose of the perforations in metal pan acoustic ceilings is to allow free flow of the sound waves out of the room and into contact with an absorber. In the suggested design, a single sound absorbing and insulating blanket was used above the coil to obtain thermal insulation, acoustic absorption, and vapor resistance. Such economy of material should lessen the acoustic and radiant panel price difference.

3. A cooled luminaire has been developed to be used with this suggested

design. A single modular-patterned unit combines the functions of acoustics and radiation, and air conditioning outlets are available having the same surface pattern.

4. As Mr. Leopold has shown in Appendix B, it is theoretically possible, according to this Hydraulic Analogue, to depress the temperature of a radiant panel covering practically the entire ceiling area, and, without going too close to the dewpoint, to absorb not only radiation from high temperature sources such as the sun and the lights, but also heat from room surfaces, furnishings, occupants, and air. We knew this to be not only theoretically, but also practically, possible because it has actually been accomplished in our drafting room and in the office of our company's president.

I believe there is a basic advantage in covering the entire ceiling area with cooled panels and luminaires. My belief is based upon the sense of comfort which can be *felt* when cooling panels are employed in this manner. Walking from an adjoining room of identical construction and exposure into the drafting room, previously mentioned, often led to the sensation of a 10 to 15 deg cooler temperature, even though the drafting room had no cooling facilities other than the radiant ceiling, and even though the air temperature in the two rooms was identical.

The only explanations I can give you of this phenomenon are: (1) the furnishings, walls, and floor of the room were, due to the effect of the ceiling, cooler to the touch than those in the adjoining room, so one's body would tend to lose heat to them more readily; (2) in a normal room in the summer, air warmed by lights, sun, people, etc., rises to the ceiling and warms that surface to temperatures approaching those at which we normally design and operate radiant heating panels for our winter comfort. Perhaps, then, the most notable service performed in covering the entire ceiling surface with a cooling panel is that of eliminating this normal summer condition of radiant heat emission from the ceiling.

To fully comprehend the possible implications of the latter concept, it must be kept in mind that the heat in warm air which has risen to the ceiling is essentially removed from our comfort consideration if it cannot warm a surface. This is true because it is impossible for air to radiate energy; only a solid object warmed by the air can radiate the heat energy to the living zone where it will affect comfort.

If this concept is true, it would explain why it is so desirable to employ a panel covering the entire ceiling surface rather than to use small dispersed panel areas. If the panel covers the entire ceiling, no surface is heated by the rising warm air currents. (Upper walls are apparently kept sufficiently cool by direct radiation to the cooled ceiling surface).

I mention this unproved explanation only because the data on the actual heat removed by these room-size ceiling panels affords no explanation of the relative sense of comfort *felt* upon entering the rooms.

Incidentally, during the winter, drafting room occupants were unaware of room air temperature depression, by ventilation, to as low as 63 F.

I should like to ask Mr. Leopold what Btu-per-square-foot heating capacities he has observed in either his commercial metal panel installations or in tests. I should be interested also in the percentage of increased cooling panel performance produced by the special copper phosphate heat absorbing paint he mentioned a few minutes ago, though perhaps this information is to be found in the data section of the paper.

AUTHOR'S CLOSURE: I deeply appreciate Professor Hutchinson's comment. In late 1945 or early 1946, when I first realized that a large portion of the energy of a luminaire would be absorbed by the structure and could be dissipated even by a panel maintained at, or above, room temperature, I telephoned Professor Hutchinson to try to arrange for a laboratory check. It was not possible to change his laboratory schedule, but he kindly agreed to run an over-night test in the research residence on the Purdue campus. Professor Hutchinson phoned the results the next morning and, fortunately, the tests confirmed the theoretical conclusions.

I appreciate the comment by Mr. Simons, vice-president of *The American Society of Refrigerating Engineers*, and the fact that he has travelled 3000 miles to discuss this paper.

I agree with Mr. Simons on the desirability of including the various analogue set-ups for Appendix B and must plead length of paper and lack of space as the reason for its omission.

In regard to the mean radiant temperature, I am in general agreement with Mr. Simons' statement, with the following qualification. For simplicity, I have analyzed the unit area in an infinite interior zone. If walls or furniture had been present, the storage would have been approximately the same, but the increase in mean radiant temperature would have been considerably less.

Mr. Wiggs has suggested that, since we call panel heating systems *radiant heating systems*, the term *radiant cooling systems*, rather than *panel cooling systems*, might be used. Since convection has such a large part both in heating and cooling, I think it is correct to refer to *panel heating and cooling systems*. The term *radiant heating* has been generally misunderstood by the public, since it was confused with heating by small radiant sources at high temperature, a system in which the convection effect is greatly minimized. F. W. Hutchinson has discussed this point in an article titled *The Myth of the Indoor Sun**.

*Heating, Piping & Air Conditioning, December 1949.

The statement that extruded panels 0.08 in. thick have proved cheaper in Canada than the original 0.062 in. thick panels manufactured in the United States requires explanation. The panels in the United States are actually less costly than the Canadian panels, as the United States manufacturer had the know-how to extrude panels of the thinner material.

The use of panels for special areas of high heat load should be carefully studied. They will be most effective where a large percentage of the internal heat load is in the form of radiant energy and where the temperature of the panel can be depressed without approaching the maintained room dewpoint.

Mr. Jorn quotes me as utilizing panels grouped around windows and on the ceiling at *essentially room temperature*. I have pointed out that the ceiling panels, in particular, will remove a considerable amount of high temperature radiant energy if maintained at, or even above room temperature. However, I did not state, and do not mean to imply, that these panels should be operated at room temperature. On the contrary, if the temperature of these panels is lowered, they remove additional energy in the form of low temperature radiation and by convection. In my paper, I have referred to temperatures substantially less than room level in describing the system and in all the tests. Mr. Jorn's speculation as to why I worked at room temperature also does not conform with the statements in the paper.

There are no *mutually eliminating characteristics of acoustic panels and radiant panels*. The radiant panels can be perforated for acoustic treatment if additional treatment were necessary without appreciable effect on their thermal properties. This was so stated. The discrete panel has been described in this paper because it was found unnecessary to treat a large part of the ceiling. This left the remaining portion of the ceiling construction to be selected according to the needs.

Mr. Jorn's ensuing discussion is largely concerned with the economics of cooling an entire ceiling with a thermal bond which is formed by forcing the ceiling material against the coolant pipes with a spring clip, as compared with the formal panel construction where there is a tight thermal bond. I have no brief for either method. This problem, I hope, will be solved eventually by competition.

Mr. Jorn refers to radiant cooling. I hope that the term panel cooling remains because it is less misleading to the public.

As Mr. Jorn implied, and as I have stated in my paper, I believe that there is a field for panel cooling without the introduction of air for dehumidification. I will caution, however, that such applications must be very carefully studied where condensation would cause damage.

I have noted the comment on the improved feeling of comfort in the panel

cooled, as compared with the conventional room construction, and again, I recommend caution. In our tests in the cubicle described in the first paper of this series, there was a continuously cooled ceiling and, as far as spot judgment is concerned, the lowering of the mean radiant temperature had a minor effect and about as much as would be anticipated from previous work. The unusual observation, if correct, was the effect on winter comfort that I mentioned and which Mr. Jorn confirms. I do not know whether or not the comparison is valid because the ceiling panels in our installation were usually below room temperature and were never used for heating.

My observation does not check Mr. Jorn's speculation that there would be noticeable difference in thermal currents with a partly cooled ceiling, and that the continuously cooled ceiling, therefore, was preferable. Our tests indicated a markedly low air motion and an even temperature, floor to ceiling, to within a few inches of the panels. There were no noticeable comfort effects due to the relative position of the occupant's head and the pattern of panels on the ceiling.

Again, in the absence of carefully controlled tests, I should like to advise caution due to the difficulty of drawing any conclusions on comfort.

The question Mr. Gonzalez raised caused me some concern when I first embarked on the design of an actual panel cooling system. There were good indications in our test cubicle that the lack of air motion would not be noticeable, but there was still the problem of applying these to regular working quarters. I agree that there are an appreciable number of individuals in the southwest who require what is generally considered to be excessive air motion. Consequently, in a building in Texas, air conditioned in 1938, I made provision in the outlet design which was to provide a draft for those who wanted it. Originally, a number of the office occupants used this feature. Less than 10 percent of the offices are now adjusted for anything but the most draftless operation.

In the Time, Inc. installation, which has operated through three summers, provision was made to increase the air velocity at the outlets, if required, by selecting oversized outlets and blocking a portion of them. It was found, however, that even with the small quantity of air being introduced through an over-sized outlet, the sensation of freshness, liveness, or however you will describe it, was acceptable and might be classified as superior.

In closing, I wish to thank all of the discussers for their considered opinions.

NEW ADVISORY BOARD FORMED

A board of leading industrial and academic metallurgists to advise the Research and Development Board, Department of Defense, on research aspects of some of the nation's most critical metal problems has been formed, it was announced recently. Since metals in huge quantities are essential for modern military operations, arms and armor, the new Advisory Board's work will be directly in the interest of our national security.

John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gifts to the John R. Allen Memorial Library, which is maintained at the ASHVE Research Laboratory, Cleveland, Ohio.

Bulletins of the Bureau of Mines (11 bound volumes), Department of the Interior. Gift of Walter L. Fleisher.
Heat Insulation (1950), by Gordon B. Wilkes. Gift of the author.

The presentation of textbooks and pamphlets in the field of heating, ventilating, and air conditioning and allied fields by authors and others will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

PA. COUNTY SUPPORTS AIR CLEAN-UP PROJECT

Allegheny County recently became the first municipality to take out a sustaining membership in the *Air Pollution and Smoke Prevention Association of America* when its check for $250 was presented by the Board of County Commissioners to H. F. Hebley, research consultant of the Pittsburgh Consolidation Coal Co., a vice president of the association and chairman of its membership committee.

Hundreds of municipalities are represented in the association, through individual memberships, but this is the first municipal sustaining membership recorded by Mr. Hebley.

WATER RE-USE EQUIPMENT VITAL, *ASME* IS TOLD

With water usage in this country double what it was a decade ago, selection of economical water cooling equipment necessary for the industrial re-use of water has become of vital importance as power demands increase and industries expand their water needs, the *American Society of Mechanical Engineers* heard at its recent spring meeting in Atlanta, Ga.

Headlines of water crises in New York City and elsewhere have brought to public attention basic water shortages that engineers have predicted for years, H. E. Degler, technical director of the Marley Co., Inc., Kansas City, Kan., told the group. In general, he said, water shortage has nothing to do with drought, but can be attributed to over-population in cities and increased industrial and agricultural requirements. This country's requirements are 100 billion gallons per day for everything from drinking and irrigation to making steel and watering the lawn; that is 700 gallons per day per person, he declared.

City of Roses Program Is Announced

PRESENTATION of twelve papers at three sessions will feature the City of Roses Meeting in Portland, July 2 to 4. With the selection of these papers by the Program and Papers Committee, the program is now complete, General Chairman B. W. Farnes said in urging members to attend and reminding them that there isn't too much time left in which to make plans. (A mailer containing reservation forms both for the special events program and for hotel accommodations was sent to all members).

The first technical session, the program disclosed, will be held on Monday morning, July 2, at 9:30 a.m. Papers to be presented at this session are:

Aluminum Ceiling Panels for Heating and Cooling, by E. S. Howarth, S. C. Huddleston, and R. M. Koch; Laboratory Studies of the Thermal Characteristics of Plaster Panels, by C. M. Humphreys, C. V. Franks, and L. F. Schutrum; Optimum Panel Surface Distribution Determined from Human Shape Factors, by F. W. Hutchinson and Merl Baker; Barometric Draft-Control Analysis, by H. B. Nottage, D. W. Locklin and R. G. Huebscher.

The second session will be held on Tuesday morning, July 3, also at 9:30, and subjects to be discussed are:

Control of Air Streams from a Long Slot, by Alfred Koestel and Chia-Yung Young; Pressure Losses of Take-Offs for Extended Plenum Duct Systems, by J. W. Holl, S. F. Gilman, R. J. Martin, and S. Konzo; Warm Air Perimeter Heating — Heat Emitted from Floor Surface, by J. R. Jamieson, R. W. Roose and S. Konzo; and Furnace Thermal Efficiency Determined from Flue and Jacket Loss, by H. L. McPherson, K. L. Badger and W. S. Zawada.

An added technical treat will follow the City of Roses Luncheon, when Dean G. W. Gleeson, School of Engineering and Industrial Arts, Oregon State College, will address the group on the subject, Energy — Choose It Wisely Today for Safety Tomorrow.

Beautiful Crater Lake is one of many breathtaking natural spectacles awaiting members who attend the City of Roses Meeting in Portland July 2 to 4

The third and final session, to be devoted mainly to the heat pump, will be held on Wednesday morning, July 4, at 9:00 a.m. Papers to be presented are:

Heat Pump Application to a Newspaper Plant, by J. D. Kroeker, J. H. Bonebrake, and J. A. Melvin; Heat Pump System in Modern Office Building Furnishes Year-Round Air Conditioning, by E. R. Ambrose; Climatology as an Aid in Heat Pump Design, by G. S. Smith; and Heat Requirements of Buildings, by C. W. Signor.

Fine Entertainment Program

Sufficient opportunity for fun and fellowship will be offered through an outstanding program arranged by the Committee on Arrangements of the Oregon Chapter.

First on a long list of interesting events is a golf tournament scheduled for Monday morning, July 2, and all the Sneads and Hogans, whether they shoot in the low 70's or high 100's, will have an equal chance for numerous awards.

At the same time, non-players and their families will go to see the Grotto (Sanctuary of Our Sorrowful Mother) and to famed Columbia River Highway, located at the foot of many waterfalls and rock wall glens, and providing an excellent view of the surrounding countryside. In the evening, all will gather for an informal Hawaiian Party in an atmosphere of real Hawaiian leis and true Island music.

On Tuesday morning, while the technical session is being held, the ladies will have brunch and visit the many attractive stores in Portland.

In the afternoon, all will tour over roads lined with rhododendron, manzanita, and squaw grass, with rustic Timberline Lodge as their destination. At the Lodge, located high on Mt. Hood and hewn from beautiful native timber, the ladies may ride in the ski-lift or sky coach, if they choose, or merely sit back and enjoy the incomparable view. In the late afternoon, all will join beneath the stars at the Lodge for an Indian-Style Salmon Bake, to be prepared by a master of the art.

PROGRAM 1951 SEMI-ANNUAL MEETING
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
Portland, Oregon
July 2, 3 and 4

Sunday—July 1

9:00 a.m. REGISTRATION
Council Meeting
2:00 p.m. Sightseeing tours about City with Chapter Members in private cars

Monday—July 2

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
Aluminum Ceiling Panels for Heating and Cooling, by E. S. Howarth, S. C. Huddleston and R. M. Koch
Laboratory Studies of the Thermal Characteristics of Plaster Panels, by C. M. Humphreys, C. V. Franks and L. F. Schutrum
*Optimum Panel Surface Distribution Determined from Human Shape Factors, by F. W. Hutchinson and Merl Baker
*Barometric Draft-Control Analysis, by H. B. Nottage, D. W. Locklin and R. G. Huebscher
12:30 p.m. to 5:30 p.m. Golf Tourney, Glendoveer Course
12:30 p.m. Columbia River trip with snack at Multnomah Falls
7:00 p.m. Hawaiian Buffet Dinner Party — Dinner-Entertainment-Dancing

Tuesday—July 3

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
Control of Air Streams from a Long Slot, by Alfred Koestel and Chia-Yung Young
Pressure Losses of Take-Offs for Extended-Plenum Duct Systems, by J. W. Holl, S. F. Gilman, R. J. Martin and S. Konzo
Warm Air Perimeter Heating — Heat Emitted from Floor Surface, by J. R. Jamieson, R. W. Roose and S. Konzo
Furnace Thermal Efficiency Determined from Flue and Jacket Loss, by H. L. McPherson, K. L. Badger and W. S. Zawada
10:30 a.m. Ladies Brunch and Shopping Trip
12:00 noon Luncheon
Speaker: Dean G. W. Gleeson, School of Engineering and Industrial Arts, Oregon State College
Subject: Energy — Choose It Wisely Today for Safety Tomorrow
2:00 p.m. Scenic trip — to Mt. Hood and Timberline Lodge
6:00 p.m. Indian Salmon Bake

Wednesday—July 4

9:00 a.m. REGISTRATION
9:00 a.m. TECHNICAL SESSION
Heat Pump Application to a Newspaper Plant, by J. D. Kroeker, J. H. Bonebrake and J. A. Melvin
Two-Year Performance of a Heat Pump System Furnishing Year-Round Air Conditioning in Modern Office Building, by Philip Sporn and E. R. Ambrose
Climatology as an Aid in Heat Pump Design, by C. S. Smith
*Heat Requirements of Buildings, by C. W. Signor
10:00 a.m. Mollala Round-up
1:30 p.m. Inspections — Country's two largest heat pumps
7:00 p.m. Semi-Annual Banquet

*To be presented by title

On Wednesday morning, following the technical session, members and their families will enjoy a special treat in the form of a Mollala Buckaroo, a unique spectacle of the old west. In the evening, the Semi-Annual Banquet will climax the City of Roses Meeting.

Transportation

Because the Northwest is rich in scenic beauty, many members are planning to make the City of Roses Meeting a part of their vacation this year. Those driving can make a circle tour that will enable them to see the world-renowned national parks of the United States and Canada, including a boat trip to Vancouver Island. Those who prefer to fly to Portland will be pleased to know that a 44-seat flight has been arranged pending reservations. For members' pleasure, a request has been made that the flight be varied to include Crater Lake and Mts. Lassen, Shasta, and Hood. (Provision to make reservations on this flight is included in the previously-mentioned mailer.) Portland is also served by Northwest and Western Airlines and various circle trips from Southeastern and Canadian Cities may be arranged with local airline agents.

For those members preferring train travel, there are a number of combinations to permit travel by Northern, Southern or Central Routes, and thus the member may see many of the national parks enroute to Portland or on the way home. Local ticket agents can give full information about the most desirable going and alternate return routes. While the member is in Portland, he may also make side trips to Mexico, Hawaii, or Alaska.

Whether the member comes by car, rail, or plane, here are some of the places he can see enroute — Black Hills, Pikes Peak, Rocky Mountains, Estes, Yellowstone, Teton, Zion, and Glacier Parks, Grand Canyon, Feather River Canyon, Hoover Dam, Sun Valley, Yosemite, Jasper Park, and the Canadian Rockies.

Regardless of how members come, the Oregon Committee on Arrangements urges that they do come for a meeting that they will always recall with pleasure.

Prof. E. O. Eastwood,
Honorary Chairman

B. W. Farnes,
General Chairman

F. F. Urban,
Vice Chairman

H. W. McKenzie,
Chapter President

Portland Committee On Arrangements Urges Large Membership Attendance

They Take Brief Time-Out for Some Humorous Job Portrayals

Now that the program for the City of Roses Semi-Annual Meeting is completed (see page 130), the chairmen of the Portland Chapter's Committee on Arrangements took a brief time-out this month to introduce themselves via the humor photos on this page and to make a concerted plea for a large member turnout. The program, they reveal, will pack into three days as many technical papers and as much of the famed Northwest flavor as is humanly possible. It will, indeed, be a program that members will always recall with pleasure, they promise. Those working to make it just such a program are:

Prof. E. O. Eastwood, honorary chairman; H. W. McKenzie, chapter president; B. W. Farnes, general chairman; and F. F. Urban, vice chairman. *Banquet*: T. E. Taylor, chairman; W. B. Hayes, vice chairman; E. A. Ponder, Mrs. Helen P. Woolley, and R. W. Zanders. *Entertainment*: E. R. Lokey, chairman; W. R. Norte, vice chairman; J. P. Byrne, J. E. Finkbeiner, D. M. Keefer, W. H. Oscanyan, W. A. Pindell, J. W. Wallace, Jr., and S. W. Young. *Finance*: J. D. Kroeker, chairman; L. J. Harrington, vice chairman; P. L. McManus. *Ladies*: J. P. McDermott, chairman; K. H. Hanson, vice chairman; J. H. Bonebrake, T. H. McClung, W. R. Norte, and Fred Schwan. Mmes. Dick Blankenship, J. H. Bonebrake, C. W. Brissenden, R. C. Chewning, B. W. Farnes, J. A. Freeman, K. H. Hanson, Walter Hanthorn, A. N. Hoss, J. D. Kroeker, T. C. Langdon, R. P. Lankow, E. R. Lokey, F. W. McCarthy, T. H. McClung, J. P. McDermott, H. W. McKenzie, W. B. Morrison, W. R. Norte, W. R. Pindell, Fred Schwan, W. A. Simpson, T. E. Taylor, B. M. Thornburg, and F. F. Urban. *Publicity*: A. N. Hoss, chairman; V. A. Beers, vice chairman; D. W. Chase, R. M. Hermann, E. R. Hoerner, W. J. Kollas, and F. E. Mulford. *Reception*: W. B. Morrison, chairman; O. W. Matthews, vice chairman; D. L. Benz, J. S. Bowen, Jr., W. R. Burton, C. P. Dougherty, R. E. Duke, R. M. Finklea, R. S. Freidenrich, R. O. Haneberg, H. H. Hewitt, Jr., F. R. Johnson, E. F. Kugel, R. F. Marquess, H. W. Olson, R. L. Schroeder, and S. W. Young. *Sessions*: F. W. McCarthy, chairman; W. C. Kelly, vice chairman; J. S. Bowen, Jr., Faruk Konuk, and W. D. Maxwell. *Sports*: R. P. Lankow, chairman; R. L. Schroeder, vice chairman; J. A. Reynolds, R. E. Selberg, and W. G. Woolley. *Attendance Promotion*: C. W. Brissenden, chairman; A. C. Clark, vice chairman; R. H. Brown, K. N. Flocke, and W. R. Pindell. *Transportation*: J. A. Freeman, chairman; W. A. Simpson, vice chairman; R. R. Atkinson, A. H. Bohren, J. T. Burtchaell, R. L. Carlson, E. E. Carroll, O. E. Castrow, L. D. Copenhagen, M. O. Cox, A. E. Finlay, W. A. Gish, Walter Hanthorn, L. O. Howlett, O. T. Jacobson, A. E. Kendrick, T. C. Langdon, A. L. Lewis, R. H. Lord, J. M. Lott, R. W. Martig, W. C. Miller, Benjamin Morris, E. A. Murhard, K. R. Murhard, H. H. Nesbitt, R. W. Peterson, V. A. Pfeifer, W. P. Ramsey, J. A. Reynolds, Jack Rousseau, R. B. Rowan, Henry Rudell, P. F. Sansted, E. P. Siegert, U. G. Smith, F. A. Staten, C. L. Walker, A. S. Weiant, W. J. Widmer, and W. G. Woolley. *Alaska Representative*: R. D. Hoss. *Special Activities*: Dick Blankenship, E. E. Kelly, R. T. Mudge, and B. M. Thornburg.

A. N. Hoss, *Publicity*

J. D. Kroeker, *Finance*

R. P. Lankow, *Sports*

T. E. Taylor, *Banquet*

F. W. McCarthy, *Sessions*

J. P. McDermott, *Ladies*

W. B. Morrison, *Reception*

J. A. Freeman,
Transportation

C. W. Brissenden,
Attendance Promotion

E. R. Lokey, *Entertainment*

Summary of Chapter Meetings

KANSAS CHAPTER HOLDS CHARTER MEETING

Another new chapter was launched with the Charter meeting of the Wichita group in the Walnut Room of the Hotel Lassen, Wichita, Kan., March 6. Pres. L. E. Seeley, who was introduced by H. L. Stevens, Hutchinson, Kan., made the charter presentation to Chapter Pres. R. F. Bauer. In his acceptance speech, President Bauer thanked those present for their work in helping to form the chapter and asked for their continued effort.

Kansas City Chapter Secretary W. A. Reichow then presented the secretary's minute book to E. G. Fahnestock, secretary of the new chapter. Congratulations and greetings followed from Kansas City Chapter Vice Pres. C. W. Schumacher and former Council member D. M. Allen, who is also a member of the Kansas City Chapter.

At the conclusion of their remarks, Dean Seeley presented an interesting historical sketch of the Society. He spoke not only of its original aims, but also of its present day activities and objectives. He went on to explain the inter-workings of the Committee on Research and the Technical Advisory Committees and then pointed out some of the results made possible by Society efforts. In conclusion, he urged all to attend Society meetings. After a brief question and answer period at the conclusion of Dean Seeley's address, temporary officers were ratified as permanent.

During preliminary proceedings, Thomas Peddy, president of the *Wichita Architects Association*, and Guy Shelley, president of the *Wichita Engineering Society*, were introduced. Photographers from local papers were on hand. Attendance 37.

EMPIRE STATE CAPITAL RECEIVES CHARTER

The charter meeting of the Empire State Capital Chapter of ASHVE was held at Panetta's Restaurant, Menands, N. Y., January 15, 1951, with 74 attending.

Presentation of the charter was made by Past Pres. Alfred E. Stacey, Jr., who was introduced by Central New York Chapter Pres. A. L. Jones. Mr. Stacey provided a brief history of the Society and pointed out that its formation was in much the same manner as that of the new chapter. He then read the charter and expressed his great pleasure in presenting it to Temporary Pres. R. B. Taylor. In accepting the charter, President Taylor related the history of the formation of the new chapter and pledged its continued activity. He then introduced R. A. Baker of the Central New York Chapter, who, after touching briefly on the creditable work of all chapter secretaries, presented the chapter record books to Secretary-Treasurer N. W. Burrill.

Following a short intermission 1950 Pres. Lester T. Avery delivered the evening's address on the subject, *Personal Air Conditioning*. Mr. Avery directed the talk largely to the ladies, to help them realize the complexities of their husbands' work. He touched on the various functions of air, but mainly spoke of environmental air.

Mr. Avery then went on to explain the concept of *effective temperature* with the aid of the ASHVE Comfort Chart. The comfort zones shown by the chart for summer and winter conditions, however, are not reliable, he said. Most people are comfortable in all seasons at a dry bulb temperature of about 75 F and with relative humidities of 30 to 50 percent, according to recent studies. *Thermal shock* does not appear to be a problem with people entering or leaving spaces maintained at those conditions, he said in conclusion.

• *ATLANTA*—March 12, 1951. *City Code Requirements for Heating and Air Conditioning* was the subject of a panel discussion at the Chapter's meeting in the Sara Halcombe Tea Room, Atlanta, Ga.

Guest speakers, from the Smoke Abatement Bureau, Building Inspection Department, City of Atlanta, were: Messrs. Tidmore, Thomas, Williams, Martin, Woffard, and Moon. Following coverage by panel members of a prepared list of 67 questions, the meeting was opened to questions from the floor and an interesting discussion resulted. Acting as moderator for the discussion was Lon Sheahan of the Atlanta Gas Light Co.

Business covered prior to the discussion included a recommendation by Pres. E. K. Jamison that the membership attend the I-B-R School to be held at Georgia Tech, April 3 to 5. He also made a brief report of his visit to the Philadelphia Meeting.

A membership vote to determine the type of social activity wanted for the May meeting resulted in the unanimous choice of a dinner-dance.

The Chapter was host at this meeting to members of the *National Warm Air Heating & Air Conditioning Association* and a number of other guests. Attendance 88.

• *ATLANTA*—February 12, 1951. Dr. Fred Manget's account of his experiences in the Far East, and particularly in Korea, provided "one of the most interesting addresses ever delivered before the Atlanta Chapter," Secretary G. B. Hightower said in reporting the meeting held in the Harris Tea Room, Atlanta, Ga. Among the many highlights of the address, entitled *Present Day Conditions in China, Korea, and Japanese Areas*, was Dr. Manget's experiences with the Communist forces during the early days of the invasion of Korea.

In the absence of Pres. E. K. Jamison, the meeting was conducted

by Vice Pres. J. J. O'Shea. Program Chairman W. J. McKinney outlined tentative plans for programs during the coming year, at the same time requesting program and speaker suggestions. Membership Committee Chairman H. W. Harrison requested members to solicit new members. Attendance 39.

• *BALTIMORE*—March 21, 1951. *Getting the Most Out of Automatic Controls* was the evening's feature address at the Chapter's meeting in the Engineers Club. The speaker, H. W. Alyea, chief engineer, Johnson Service Co., described at length typical installations of thermostats and static pressure controls in standard practice. He then went on to point out the use of these controls in special applications.

Among business covered prior to the address was the election of a nominating committee. Those named were: E. L. Crosby, *chairman;* E. J. Morris; W. J. Law; G. B. Priester; and S. Y. Smith.

President Priester presided. Attendance 52. Attendance ratio 0.51*.

• *BALTIMORE*—February 21, 1951. The board of directors and committee chairmen of the Baltimore Chapter met at 5:30 p.m. in the Engineers' Club. Following dinner at 6:30 p.m., the regular monthly meeting of the Chapter was called to order.

Representatives of the DuPont Co., L. L. Falk of the Wilmington Plant, C. E. Smith, local plant manager, and Robert Aiken, technical assistant, held a discussion on *Air Pollution.* Each dwelt on methods and equipment for smoke and fume abatement, locally as well as nationally. Attendance 41. Attendance ratio 0.44.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *CENTRAL NEW YORK*—February 21, 1951. The meeting was called to order by Pres. A. L. Jones in the Howard Johnson Restaurant, De Witt, N. Y., and the minutes of the previous meeting were read and approved. The speaker of the evening, R. S. Dill, chief, Heat and Air Conditioning Section, National Bureau of Standards, Washington, D. C., delivered an address on the subject, *Research on Domestic Heating in the United States.* At the conclusion of Mr. Dill's address, the meeting was opened to a question and answer session. Attendance 29.

• *CENTRAL OHIO*—February 19, 1951. The meeting was called to order by Pres. H. G. Hays in the Southern Hotel at 8:00 p.m. and the minutes of the January meeting were read and approved. This was followed by the reading of the treasurer's report and a reminder on payment of 1951 dues. R. J. Schmitz, Jr., program chairman, then called on two chapter members, A. F. McGovern and R. W. Pirrung, who gave short talks on how they rose from *rags to riches* thanks to the heating industry.

The speaker of the evening was W. K. Sidwell, assistant manager of research and development for general products of the Owens-Corning Fiberglas Co., Toledo, who spoke on *The Research and Practical Phases of Moisture Control.* Mr. Sidwell showed slides to illustrate his presentation, which was followed by an interesting question and answer period. Attendance 34. Attendance ratio 0.25.

• *CINCINNATI*—February 6, 1951. Pres. E. W. McNamee called the meeting to order in the Engineering Society Headquarters at 7:45 p.m. and the minutes of the January 15 meeting were read and approved. R. C. Beineke, program chairman, announced that the March meeting would feature a panel discussion and President McNamee announced that the Annual Ladies Party would be held March 10 at the Kemper Lane Hotel. President McNamee then gave a report on the Chapters Conference Committee in Philadelphia and announced that H. E. Sproull had been elected treasurer of the Society. Following a brief report on the Annual Meeting and the Exposition, Mr. Sproull gave a schedule of Society Annual and Semi-Annual Meetings to follow. H. K. Jennings proposed that the nominating committee be composed of five past presidents and the motion was seconded with K. B. Little acting as chairman.

E. J. Kramer introduced B. G. Silberstein, district manager of Ilg Electric Ventilating Co., Cincinnati, and member of the Cincinnati Chapter, who showed colored pictures of his trips to Peru and Mexico. Mr. Silberstein has gained national recognition in the field of photography and his pictures have appeared in leading national magazines. A rising vote of thanks was extended to Mr. Silberstein and the meeting adjourned at 10:00 p.m. Attendance 38. Attendance ratio 0.34.

• *DELTA*—February 12, 1951. A joint meeting with the *Louisiana Engineering Society* featured the Chapter's regular monthly session in the Jackson Room of the St. Charles Hotel, New Orleans, La. Pres. Ralph Elizardi presided and welcomed the opportunity of meeting jointly with the *LES.*

The guest speaker was J. M. Guillory, manager, Industrial and Commercial Division, New Orleans Public Service, Inc. He spoke on the subject, *Industrial Developments in the Middle South.* An interesting question and answer period followed the address. Attendance 60. Attendance ratio 0.25.

• *EMPIRE STATE CAPITAL*—February 20, 1951. Election of officers for the newly formed chapter was held at the group's regular monthly meeting in Panetta's Restaurant, Menands, N. Y. Elected were: *president*—R. B. Taylor; *first vice president*—D. A. Carofano;

A get-together of Golden Gate Chapter members and ladies

second vice president—Harry Horowitz; *secretary-treasurer*—N. W. Burrill; and *board of governors*—Wendell Westover, C. D. Cross, F. A. Weinbender, and G. G. Davis. President Taylor presided. Attendance 29.

• *GOLDEN GATE*—February 1, 1951. Pres. R. C. Cushing called the meeting to order at 7:45 p.m. in the Engineers' Club, San Francisco, Calif., and members introduced themselves and their guests. The guest speaker, Admiral A. G. Cook, head of the San Francisco Civilian Defense Program, gave a report on the progress made in the civilian defense program in San Francisco and explained the part engineering groups could play.

Following Admiral Cook's talk, the minutes of the previous meeting were read and approved, and President Cushing announced the appointment of the various committee chairmen. Those named are as follows: *membership*—E. F. Dill, *attendance*—Eric Roberts, *reception*—T. C. Douglass, Jr., *technical*—H. V. Hickman, *finance*—H. R. Scandrett, *legislation*—F. W. Kolb, and *publicity*—D E. McLeod. Mr. Dill stated that his committee would contact all men in the industry who might be eligible for membership, while Mr. Roberts stated that it was his objective to have a larger attendance at the monthly meetings. Attendance 63.

• *ILLINOIS*—March 12, 1951. There is no need of rationing petroleum products now, D. S. Warning, assistant general manager, Distribution Economics Department, Standard Oil Co., Indiana, said, in his address before the Illinois Chapter in the M & M Club, Chicago. There is sufficient yield flexibility to supply the quantities of individual products required, he revealed, provided maximum seasonal inventory accumulations take place.

Stating that crude runs are adjusted as far as possible to bring supplies in line with demands, Mr. Warning emphasized that the simple economics of supply and demand regulate the yields of various products. Government management of each product would be too slow and unwieldly, in his opinion. "We would," he said, "feel more sure of guaranteeing that necessary yield shifts would take place if price controls were not in effect."

Discussing the petroleum fuel outlook, he estimated that this year would show a 10 percent increase in crude runs over 1950. His forecast of demand for major products showed distillates up 10 percent, residual fuels up 4.3 percent, gasoline up 10.6 percent, kerosene up 9.2 percent, and all other products up 8.2 percent.

At the same meeting, M. B. Nugent, Sahara Coal Co., Chicago, described the coal industry as one composed of approximately 5,000 companies operating 9,000 mines in 28 states. It is a highly competitive industry, now producing 500,000,000 tons per year, he disclosed, and it could probably produce 700,000,000 tons. Following a review of the industry's 1950 accomplishments which revealed that more coal per man-day was produced than ever before and the best accident prevention mark was recorded, Mr. Nugent said that the industry is now in better shape than at any previous time. It can fill the gaps if other fuels become short, he pointed out, and it does not require retooling to serve wartime requirements.

Limitations orders applying to the use of gas for space heating in the Chicago area were described by D. E. Collins of Peoples Gas Light and Coke Co. There are now over 90,000 applications for gas heat on file and a new pipe line from the Gulf Coast area of Texas now under construction will permit some 20,000 heating jobs to be added to the company's lines in June, it was revealed. Three other methods for obtaining more gas are now being studied; they include storage in depleted wells, liquefaction of gas, and gas storage in underground sandstone strata near Kankakee, Ill.

Among business covered before the addresses, was announcement of the nominating committee, consisting of M. J. Bamond, M. W. Bishop, G. W. Bornquist, J. S. Kearney, W. A. Kuechenberg, P. J. Marschall, and G. V. Zintel. President Marschall presided. Attendance 113. Attendance ratio 0.18.

• *ILLINOIS*—February 12, 1951. Pres. P. J. Marschall called the meeting to order at 7:45 p.m. in the M & M Club and the out-of-town guests were introduced. President Marschall announced that there had been 50 Illinois Chapter members registered at the Meeting in Philadelphia and also announced that J. S. Kearney, C. M. Burnam, Jr., and W. A. Kuechenberg, the last three past presidents, had been appointed as Illinois Chapter delegates to the Illinois Engineering Council.

The meeting was then turned over to the co-chairmen of the meeting, H. E. Clo and F. E. Zimmerman. The general topic of the evening was *Atmospheric Pollution* and the first speaker was Guenther Baumgart, secretary of the Cleaner Air Committee of the Chicago Association of Commerce and Industry. Mr. Baumgart spoke of the work done in Chicago, starting in 1910, by the close cooperation of industry with the City engineers and officials.

The second speaker was J. M. Kane, manager, Dust Control Division, American Air Filter Co., Louisville, Ky., who spoke on, and demonstrated with slides, the many types of air cleaners and separators used industrially. He stated that the problem of industrial air pollution is not only difficult but perplexing, inasmuch as specifications of discharge effluents are meaningless because of dilution factors. For this reason, a visual method of determining concentrations, such as the Ringelmann Chart, is useless, he stated. For an industrial process discharging certain contaminants and causing a certain dustfall, the discharge concentration is dependent upon an amount of air used and hence the dilution. For the same dustfall, an unlimited number of concentrations may be obtained. With respect to city codes and regulations, he pointed out the importance of giving plant management assurance that a satisfactory method of reducing air pollution will still be satisfactory five or ten years from now.

In speaking of recirculation of air, Mr. Kane expressed the opinion that it is satisfactory where toxic substances are not produced, but dangerous where they are present because it is impossible to determine when the cleaning equipment is not functioning properly. Adequate warning devices, he said, are not now available. President Marschall closed the meeting following a brisk question and answer period. Attendance 95.

• *INDIANA*—February 23, 1951. Pres. C. F. A. Locke called the meeting to order in the Construction League Building, Indianapolis, and the reading of January minutes and introduction of guests followed. A report covering the Philadelphia Meeting was given by G. B. Supple in which he anounced future meeting sites, then mentioned the formation of the new Kansas Chapter in Wichita, and concluded by citing the appointment of I. W. Cotton, past president of chapter, as chairman of Committee on Research and Nominating Committee member. Mr. Cotton responded by describing briefly some of the Committee on Research duties and problems.

The guest speaker was Earl Michel, Worthington Pump and Machinery Co., who spoke on the subject, *Low Temperature Refrigeration*. Attendance 33.

• *INLAND EMPIRE*—March 16, 1951. Pres. W. C. Vradenburg called the meeting to order in the Spokane Hotel, and, following the reading and approval of February minutes, reports were given by T. P. Nau, L. E. Marque, G. M. Dieter, and J. E. Hutsinpiller. K. E. Hanson, sales engineer, Minneapolis-Honeywell Regulator Co., Portland, Ore., was the speaker. He gave a paper on electronic controls, prepared by Mr. Fuber of his company. Attendance 24.

• *INLAND EMPIRE*—February 9, 1951. The meeting was called to order at 7:30 p.m. in the Spokane Hotel by Pres. W. C. Vradenburg and following the introduction of guests, the minutes of the previous meeting were read and approved. Reports were given by the treasurer, and the program, attendance and publicity committees. It was announced that the 1951 Semi-Annual Meeting is to be held in Portland, Ore., in July.

L. E. Marque introduced the speaker of the evening, M. N. Musgrave, owner, Merrill N. Musgrave & Co., Seattle, Wash., who gave a talk on the national situation as it pertains to engineering groups in regard to business, priorities, etc. The meeting adjourned at 10:30 p.m. Attendance 20.

• *KANSAS CITY*—March 5, 1951. Members and guests met in the Roof Garden of the Aladdin Hotel, Kansas City, and Pres. W. E. Howarth called for the reading of the minutes of the February meeting, which were approved as read.

The speaker of the evening was L. E. Seeley, president of the Society and dean, College of Technology, University of New Hampshire,

Durham, N. H. Dean Seeley spoke on the subject, *Engineering with the Human Touch*, explaining how he personally conducted experiments on reaction of the human body to temperature and humidity. One conclusion which he drew from these experiments was that if inside temperature was maintained at approximately 70 F with 40 to 50 percent RH, the evaporative loss in the nasal passages would be about the same as the average outdoor air condition, and would thus prevent shock to the respiratory system.

Dean Seeley indicated that his personal feelings are that engineers are dealing not only in engineering, but in physiology and psychology, and stated "No amount of excellency in your work can overcome personal opinion." An interesting question and answer period followed Dean Seeley's talk. Attendance 78. Attendance ratio 0.36.

• *MANITOBA*—February 15, 1951. The meeting was called to order by Pres. C. M. Fleming in Salon A of the Fort Garry Hotel. W. D. Hurst, chief engineer, City of Winnipeg, was the speaker of the evening. His wide experience in city engineering served to provide an excellent address for members and guests. One of the highlights was a film which illustrated the construction of an underground tunnelling for a sewer running from McPhillips to Jefferson Avenues in Winnipeg.

G. L. Ballantyne, manager, Crane Ltd., Montreal, was scheduled to be the speaker at the March meeting, President Fleming announced. J. F. Bertram, A. K. Piercy and K. Watton were appointed as members of the telephone committee for the March meeting. Attendance 12.

• *MASSACHUSETTS*—February 20, 1951. A social hour and dinner was held in the Campus Room of the M.I.T. Graduate House at 5:30 p.m. and Pres. D. W. Blair welcomed the members and guests. It was announced that at the meeting of the board of governors held previously it was voted to present the Engineering Societies of New England Library with a year's subscription to the ASHVE JOURNAL, the 1951 edition of THE GUIDE, and a copy of the TRANSACTIONS. President Blair informed the members that the Massachusetts Chapter had extended an invitation to the Society at the 57th Annual Meeting in Philadelphia to hold the 1954 Meeting in Boston.

President Blair opened the regular meeting with a report on the Annual Meeting. John Bonner, chairman of the program committee, introduced the speaker of the evening, J. W. May, technical director, Air Filter Division, American Air Filter Co., Louisville, Ky. Mr. May spoke on *Present Standards in the Application of Air Filters*, giving a very interesting discussion on the three types of air filters, viscous impingement, dry or semi-dry and electrostatic, and outlined their uses, efficiencies and applications. He brought out in his talk that primary consideration should be given to the cleaning efficiency, the filter life, resistance to air flow and the type of dust. Slides were shown after which a short discussion period was conducted. Attendance 45. Attendance ratio 0.31.

• *MEMPHIS*—February 19, 1951. The meeting was called to order by Pres. C. S. Fischer in the King Cotton Hotel and minutes of the January meeting were read and approved. Following reports by E. E. Scott and T. J. O'Brien, President Fischer appointed the following to serve as the nominating committee to select candidates for the 1951-52 election, to be held April 16: R. H. Hoshall, *chairman;* W. L. Welford; N. C. Ledbetter; and Messrs. Scott and O'Brien.

Henry Sleik, vice president, W. B. Connor Engineering Corp., Danbury, Conn., was guest speaker. His subject was *Odors—Their Nature, Cause, and Control.* The meeting was interrupted at 8:15 p.m. to hear a broadcast commemorating Engineers Week. Attendance 19.

• *MICHIGAN*—March 12, 1951. The meeting, which was designated as the University of Detroit Student Branch Night, was called to order by Pres. C. F. Donohoe in the headquarters of the *Engineering Society of Detroit.* Chapter members acted as hosts to 22 members of the University of Detroit Student Branch. G. W. Akers announced that the April meeting would be the Annual Past Presidents' Night and Ladies Night combined.

G. D. Winans introduced the speaker of the evening, J. C. Rehard, chief safety engineer of the Detroit Department of Safety Engineering, who spoke on *The Problem of Water Conservation.* Mr. Rehard discussed the water conservation problems that many major cities have experienced throughout the past few years, and pointed out that water conservation may be found necessary due to a deficiency in any of the three common water sources — reservoirs, wells, and surface water. A lively discussion period followed the talk. Attendance 77.

• *MICHIGAN*—February 12, 1951. The meeting was held at the quarters of the Engineering Society of Detroit, and following dinner Pres. C. F. Donohoe called the meeting to order. The minutes of the previous meeting were read and approved and the treasurer's report was given by C. A. Strand. President Donohoe then announced that N. B. Hubbard, a highly respected and old time member of the Society and the Michigan Chapter, had passed away and the secretary would write a note of condolence to Mr. Hubbard's daughter. President Donohoe also announced that the March meeting would be the University of Detroit Student Branch Night and that the April meeting would be the Past President and Ladies Night with a popular speaker for the evening.

The speaker of the evening was J. M. Straky, plant engineer of the DeSoto Division, Chrysler Corp., who spoke on *Air Handling at the New Desoto Body Plant.* Mr. Straky

took the members on an imaginary trip through the new DeSoto Body Plant with the assistance of numerous color slides and explained the problems involved in ventilating the various areas of that plant. The immense quantities of air handled in a plant of this nature vividly illustrated the magnitude of problems in heating and ventilating a plant of this type. The problems are apparently divided in four parts as follows: (1) welding operations (2) rough body operations in white (white metal, etc.) (3) painting operations and (4) trim operations. All of the operations mentioned involve separate problems and Mr. Straky pointed out that they are approached from either one of two angles; handled under local specialized ventilation or handled under general ventilation. Mr. Straky answered questions from the floor after his presentation and a rising vote of thanks indicated that he had made a very interesting presentation. Attendance 68.

• *MINNESOTA*—March 5, 1951. The meeting was called to order by Pres. G. M. Kendrick in the Riviera Room of the Dyckman Hotel, Minneapolis, and the reading and approval of the February minutes and the introduction of guests followed. L. C. Gross then gave a report of the nominating committee. Nominees for 1951-52 officers are: *president*—E. F. Snyder, Jr.; *vice president*—B. F. McLouth and William Sturm; *secretary*—N. B. Herman and J. A. Holbrook; *treasurer*—C. L. Bensen and V. E. Pearson; *board of directors*—G. M. Brown, E. F. Juhl, L. J. Krause, and W. N. Parks; *representatives to Minnesota Federation of Engineers*—A. B. Algren and Hugo Schlenk, Jr.; and *alternate representative to Federation*—M. S. Wunderlich and C. E. Gausman.

The speaker was Martin Burke, Jr., vice president, Northwest Hanna Fuel Co., who addressed the Chapter on the subject, *The Gray Ghost of City Smog*. Attendance 69. Attendance ratio 0.22.

• *MONTREAL*—February 19, 1951. Pres. R. R. Noyes called the meeting to order in the Berkeley Hotel and the minutes of the January meeting were read and approved. A nominating committee report was made and the following selections were announced: *president*—G. J. Chenevert; *vice president*—W. G. Hole; *secretary*—B. J. Horsburgh; *treasurer*—D. L. Lindsay; and board of governors—R. R. Noyes, R. J. Ker, J. C. Hennesey, and R. A. Standring.

The speaker was R. S. Dill, chief, Heat and Air Conditioning Section, National Bureau of Standards, Washington, D. C., who spoke on the subject, *Current Research on Domestic Heating*. Attendance 55.

• *NEBRASKA*—February 13, 1951. H. E. Degler's address on the subject *Water Cooling Equipment for Air Conditioning and Refrigeration* contributed much toward an interesting evening for members and guests at the meeting in the Hotel Castle, Omaha. Mr. Degler, who is technical director of The Marley Co., Inc., Kansas City, Kan., was introduced by W. R. White, who is also associated with the company. Pres. G. W. Colburn presided. Attendance 33. Attendance ratio 0.35.

• *NEW YORK*—March 19, 1951. One hundred and sixty attended the Chapter's meeting in the Building Trades Club, New York City. Following reading and approval of the minutes of the last meeting, a new member, Stanley Dieker, was introduced. Pres. Carl F. Kayan appointed an auditing committee and board of tellers in preparation for the chapter's annual meeting April 16. Named to the auditing committee were: D. A. Newton, chairman; Herbert Demuth; and F. D. McCann. Named to the board of tellers were: F. A. Fidele, G. C. Cummings, and F. W. Gilman

The speaker of the evening was John W. James, chief research engineer, McDonnell & Miller, Inc., Chicago, Ill., who spoke on the subject *Operating Characteristics of Hot Water Heating Systems*.

• *NEW YORK*—February 19, 1951. Following a social hour and dinner, the meeting was called to order at 8:00 p.m. by Pres. Carl F. Kayan in the Building Trades Club. The reading of the minutes of the January meeting was dispensed with due to the large attendance and the anticipated length of the program. President Kayan called on H. J. Ryan to give the report of the Nominating committee for nominees for officers for the year ending May 31, 1952.

The meeting was then turned over to John B. Hewett, program chairman, who announced that the evening would be devoted to a symposium on *Air Conditioning for Multi-Room, Multi-Story Buildings*. With C. P. Roberts, chief mechanical engineer, Voorhees, Walker, Foley and Smith, New York, as moderator, the two principal speakers, A. A. Giannini, sales engineer, Carrier Corp., New York, and R. U. Berry, engineer, General Electric Co., Bloomfield, N. J., discussed a high velocity type system with induction room units and a unit type of system with fan coil units along outer walls, respectively.

Mr. Roberts outlined the problems encountered in large buildings with large glass surface areas and large perimeter spaces where it is necessary to keep occupants comfortable at all seasons of the year and where it is necessary at times to have simultaneous heating and cooling of different zones. He stated that the design problem is complicated by the need for obtaining maximum rentability, reasonable first cost, economy of building space devoted to air conditioning ducts and equipment, and at the same time insuring comfortable conditioning at all times.

Mr. Giannini described a system employing a pressure of 7 to 8 in. at the fan outlet and achieving small duct sizes by increasing duct velocities to 3000 fpm. In such a system, he said, special noise reduction is necessary at the room units where the conditioned primary air is ex-

panded and then blown through nozzles to induce circulation of heated or cooled air in the room. In these units water is used as the secondary or final heating or cooling medium as desired and the primary air is used for dehumidification or humidification according to need, as well as for primary heating or cooling, Mr. Giannini stated.

Mr. Berry described units using water for heating or cooling and dehumidification and depending for ventilation upon air taken through openings from outside into the units. The room air circulation is produced by fans within the units. For weekend operation the units in this system are operated as gravity convectors without the use of outside air.

Following the talks, the speakers answered questions from the audience until the close of the meeting when they were given a rising vote of thanks for their interesting presentations. Attendance 200. Attendance ratio 0.32.

• *NORTH CAROLINA*—February 23, 1951. Pres. R. O. McGary presided and called the meeting to order in the Robert E. Lee Hotel, Winston-Salem.

Membership Chairman W. D. Graham, Jr., reported on membership prospects and on the status of applications. Publicity Chairman S. S. Simpson, Jr. reported that he had placed meeting notices in papers throughout the state.

Program Chairman J. W. Barr introduced the evening's guest speaker, Membane Turner of the R. J. Reynolds Tobacco Co., who gave an interesting talk about the tobacco industry. Mr. Turner and his assistants also took members and guests on a tour through the Reynolds plant. It was a most enlightening experience to see how two members of the Reynolds cigarette line are manufactured, Secretary J. A. Rice reported. Attendance 73.

• *NORTH TEXAS*—March 19, 1951. Pres. R. G. Lyford called the meeting to order in the Engineers' Club, and following self introduction of members and guests, the minutes of the February meeting were read and approved. This was followed by a series of reports by committee chairmen on the status of their respective committees.

L. S. Gilbert introduced the speaker of the evening, I. A. Naman, consulting engineer from Houston, Tex., who spoke on the subject, *Duct Design*. Mr. Naman based his remarks on the practical application of the laws of air flow to the construction of sheet metal ducts having minimum pressure losses. The talk was followed by an interesting discussion period. Attendance 88. Attendance ratio 0.46.

• *NORTH TEXAS*—February 19, 1951. Pres. R. G. Lyford called the meeting to order at 8:00 p.m. in the Melrose Hotel and members introduced themselves and their guests. The minutes of the January meeting were read and approved.

M. W. Brown, representing the Engineers' Club, stated that the Club was now open to reservation and he offered the Chapter the facilities of the Club as its monthly meeting place. After some discussion, it was decided to meet at the Engineers' Club in March as a trial run and that at that time a vote would be taken as to whether to continue meeting at this place or elsewhere.

L. S. Gilbert introduced L. L. Landauer, consulting engineer, Landauer & Guerrero, Dallas, who presented an interesting and informative discussion, based largely on his own experiences in panel heating. The meeting adjourned at 9:30 p.m.

• *NORTHEASTERN OKLAHOMA*—February 13, 1951. Members and guests met at Smith's Restaurant at 6:30 p.m. for dinner, and the business meeting was called to order at 7:30 p.m. by Pres. R. F. Shoemaker. After the roll was called and the guests were introduced, the minutes of the previous meeting were read and approved. V. W. Miles, the chapter's representative on the Chapters Conference Committee, was called on and gave a very interesting and detailed account of the recent Annual Meeting. Mr. Miles called on the speaker of the evening, J. R. Vernon, sales promotion manager for Johnson Service Co., Milwaukee, Wis., who also made a brief report on the activities at the Philadelphia Meeting, before speaking on *Current Practices in Automatic Temperature Control for Heating and Air Conditioning*. Mr. Vernon's talk was very well presented and illustrated, and was followed by a short discussion period. The meeting adjourned at 10:35 p.m. Attendance 27. Attendance ratio 0.78.

• *NORTHERN OHIO*—March 12, 1951. Two interesting features were presented at the Chapter's meeting in the Warner Auditorium, Cleveland. The first, preceding the meeting, was an address by Hans Segel of the Council of World Affairs in which he reviewed the current world situation, with particular emphasis on the role being played by Western Germany. The second was a color film, *New Power for America*, which showed the construction and erection of steam generating equipment in plants throughout the country. It was presented by E. L. Davis, district engineer, Combustion Engineering Co.

Announcement was made by Program Chairman L. C. Burkes that the April session would be a joint meeting with the *ASRE*. Pres. W. R. Rowe presided. Attendance 46. Attendance ratio 0.19.

• *NORTHERN OHIO*—February 12, 1951. At the dinner which preceded the business meeting, the group was addressed by W. W. Lige, chapter member, who spoke briefly on the seriousness of *hidden taxes* and his remarks evoked considerable discussion. The business meeting was called to order by Pres. W. M. Rowe in the Warner Auditorium and the minutes of the January meeting were

read and approved. John Richmond, chapter vice president, reported on the Chapters Conference Committee meeting in Philadelphia and stated that about 30 Northern Ohio Chapter members had attended the Annual Meeting. W. F. D. Neiheiser reported on the annual Cleveland Technical Societies Council banquet and stated that it was one of the finest affairs that he had ever attended and expressed the hope that the Chapter would be better represented next year.

C. M. Humphreys introduced the speaker of the evening, L. F. Collins, chemical engineer, The Detroit Edison Co., Detroit, Mich., who spoke on the subject *The Ten Commandments of Corrosion Engineering in the Industrial Water Field*. He emphasized the importance of corrosion by stating that the annual cost in the industrial water field alone was about two hundred million dollars and that this is but 3 percent of the total corrosion losses in the country. He outlined the basic nature of corrosion and illustrated his points with slides. Mr. Collins' interesting talk was followed by a lively discussion. Attendance 41. Attendance ratio 0.15.

• *OKLAHOMA*—March 12, 1951. Pres. L. E. Seeley's address, *Engineering With the Human Touch*, highlighted the Chapter's regular monthly meeting at Beverly's Drive-In. The Society, in cooperation with physiologists, has provided engineering information, problems, and solutions that should prove interesting to engineers in general, he said, particularly those whose work does not involve the same close human touch required by heating, ventilating, and air conditioning. President Seeley also spoke of certain physiological studies he has made with respired air and the results obtained.

Pres. R. E. Swan presided. Attendance 55. Attendance ratio 0.53.

• *ONTARIO*—March 6, 1951. The meeting was called to order in the Royal York Hotel, and after welcoming two new members, H. L. Best and Anatol Shuper, Pres. J. H. Fox read a report of the nominating committee. Nominations were: *president*—William Philip; *vice president*—J. H. Ross; *secretary-treasurer*—H. R. Roth; *board of governors*—N. W. Kingsland, G. P. Cooper, M. C. Bailey, Charles Torry, D. L. Angus, and G. S. McKernan (*three to be selected*).

A panel discussion on the subject *Multiple Housing* was the feature of the evening. Comprising the panel were: R. W. G. Card, architect from Toronto; G. H. Hopper, heating engineer from Toronto; and Lewis Smith, heating engineer from New York. Attendance 100! Attendance ratio 0.30.

• *OREGON*—February 8, 1951. Pres. R. C. Chewning called the meeting to order at 7:25 p.m. in the Old Heathman Hotel and the minutes of the previous meeting were read and approved. B. W. Farnes, general chairman of the Committee on Arrangements for the 1951 Semi-Annual Meeting at Portland, asked that the various committee chairmen have a complete budget submitted on or before March 24 and he indicated that the publicity campaign started at the Annual Meeting would be carried on with renewed vigor with particular concentration on the west coast. It was announced that the publicity film on the Oregon Meeting had been shown to numerous chapters and was booked solid for the balance of the chapter year and that within a month a second film would be available for circulation. President Chewning announced the appointment of the auditing committee and the nominating committee presented its report for the selection of officers for the year 1951-52.

A thorough report on the activities of the 57th Annual Meeting was given by President Chewning, H. W. McKenzie and J. D. Kroeker. The meeting adjourned at 10:30 p.m. Attendance 59.

• *PHILADELPHIA*—March 8, 1951. The meeting was called to order by Pres. J. W. McElgin in the Engineers Club and the minutes of the previous meeting were read and approved. J. W. May, technical director, Air Filter Division, American Air Filter Co., Louisville, Ky., was the speaker of the evening. The subject of his address was *Recent Trends in Air Conditioning*. Prior to Mr. May's address, the attractive color film urging membership attendance at the Society's 1951 Semi-Annual Meeting in Portland was shown. Attendance 63. Attendance ratio 0.29.

• *PITTSBURGH*—March 12, 1951. The meeting was called to order in the Hunt Room of Webster Hall, by Vice Pres. W. D. Simpson and the minutes of the February meeting were read and approved. Business covered included the appointment of the following nominating committee: D. W. Loucks, chairman; H. E. Park, and L. S. Maehling.

J. J. Kelly reported on the Chapter's annual meeting, scheduled for May 14 at the University Club. Every effort is being made to have all members present, he disclosed. It was also revealed that the *ASME* Conference is set for April 19 and 20, with a dinner meeting scheduled for the Urban Room on the final day.

Speaker of the evening was W. N. Witheridge, ventilation consultant. General Motors Corp., Detroit. His subject was *Air Cleaning Aspects of Industrial Ventilation*. Attendance 29.

• *PITTSBURGH*—February 19, 1951. Following dinner, Pres. A. F. Metzger introduced the 12 chapter past presidents who were in attendance. The business meeting was called to order at 8:15 p.m. in the Hunt Room of Webster Hall and a resolution was passed in memory of T. M. Dugan, Life Member of the Society, who passed away on January 9, 1951. The minutes of the January 8 meeting were read and approved, and reports by the treasurer and by the program and attendance committees were given.

W. D. Simpson of the program committee introduced the speaker of the evening, L. P. Saunders, technical assistant to the general manager, Harrison Radiator Division, General Motors Corp., Lockport, N. Y., who spoke on *Oil Production from Coal and Shale*. He spoke about the source of oil and gas and stated that since the last World War, new sources of oil and gas have been found, one new source being shale rock. The process of producing liquid fuel from coal in Rifle, Colo., was explained and samples were shown. Following Mr. Saunders' presentation, a question and answer period was conducted, at the conclusion of which Mr. Saunders was extended a rising vote of thanks. The meeting adjourned at 9:45 p.m. Attendance 37.

• *ROCKY MOUNTAIN*—March 12, 1951. An address by J. W. May on *The Application and Selection of Air Filters* highlighted the Chapter's meeting in the Silver Wing Inn, Englewood, Colo. Mr. May, who is technical director, Air Filter Division, American Air Filter Co., Louisville, Ky., presented data on each of the types of filters available, categorizing them by media, cleaning method, adhesion method, and structural conformity. Advantages lie in the use of specific filters for certain applications, he pointed out, and, in general, higher efficiency and lower operating cost must be balanced against higher purchase price. There is, he explained a definite application for each type of filter. Mr. May also stated that filters can be shown to be economically justifiable in certain manufacturing and process applications, as well as in air conditioning systems for retail stores.

Vice Pres. B. H. Spurlock, Jr. presided in the absence of Pres. R. W. Petersen. Attendance 76.

• *ST. LOUIS*—March 1, 1951. Pres. L. E. Seeley, dean of the College of Technology, University of New Hampshire, Durham, N. H., was the guest speaker as the chapter met jointly with the Engineers' Club and the St. Louis Section of the *ASRE* at the Engineers' Club. An audience of 130 heard Dean Seeley's talk, *Physiological Engineering*, in which he discussed both historical and contemporary phases.

Prior to the address, Pres. J. S. Rosebrough announced that arrangements had been made to hold the annual dance at the Westborough Country Club, and that plans were nearing completion. First Vice Pres. C. H. Burnap announced that L. L. Hamig was to be the speaker at the April meeting, scheduled for the Town Hall. Attendance 126. Attendance ratio 0.22.

• *ST. LOUIS*—February 6, 1951. Pres. J. S. Rosebrough presided and called the meeting to order in Town Hall. After discussions on the payment of chapter dues and the solicitation of new members, there was a report on the Chapters Conference Committee by W. W. Evans. Following this, E. G. Kuntz, F. E. Ince, and J. F. Naylor, Jr. provided a brief summary of the technical sessions attended by them at the Philadelphia Meeting of the Society. Mr. Naylor also spoke on the Exposition, remarking particularly on some of the exhibits. G. W. F. Myers then reported on the various committees for the 58th Annual Meeting in St. Louis next January and described their duties as outlined to him at Philadelphia. Attendance 36. Attendance ratio 0.24.

• *SHREVEPORT*—February 15, 1951. After calling the meeting to order at 7:45 p.m., Pres. S. W. Beaty announced the election and installation of the new Society officers at the Annual Meeting in Philadelphia. It was announced that President Beaty served as chairman of the Resolutions Committee at the Meeting. R. M. Hood reported on the activities at the Annual Meeting.

M. A. Hudson introduced the speaker of the evening, Robert Reed, chief engineer of John Zink Co., Tulsa, Okla., who spoke on *Gas Combustion*, emphasizing gas combustion burners and design, as well as flues and stacks. A short discussion period followed the talk. The meeting adjourned at 10:00 p.m. Attendance 38.

• *SOUTH TEXAS*—March 16, 1951. The meeting was called to order in the Alabama Cafeteria by Pres. H. W. Broadwell, and, following the reading and approval of minutes of the last meeting, guests from Texas A. & M. College and the University of Houston were introduced. Attending from Texas A. & M. were Prof. L. S. O'Bannon, J. R. Massey, and J. O. Kadel, president of the Student Branch at the College; while on hand from the University of Houston was Prof. A. A. Rasmussen.

President Broadwell stated that some progress had been made on the Code, revealing that Cyrus Miller, executive secretary, Refrigeration Industry Safety Advisory Committee, had met recently with W. J. Carlin, city engineer, and F. D. Garvin, to work out a code.

Professor Rasmussen, member of the research committee, stated that the University of Houston was willing to undertake any project. He also spoke of the University Career Day and disclosed activities being undertaken at the school.

Named to a committee to assist the Engineers Council in the development of a program were: Reg. F. Taylor, B. P. Fisher, H. C. Will, and A. A. Rasmussen.

The speaker of the evening was P. N. Vinther, consulting engineer from Dallas. His subject was *Air Conditioning Storage Systems for Churches and Theaters*. The talk was interesting and well received, Secretary C. L. Fleming said.

It was announced that Pres. L. E. Seeley was scheduled to be the guest speaker at the April meeting. Attendance 80.

• *SOUTH TEXAS*—February 16, 1951. Pres. H. W. Broadwell called the meeting to order in the Alabama

Cafeteria and the minutes of the previous meeting were read by Secretary C. L. Fleming, and were approved.

Business covered included: a report by Treasurer E. G. Floeter, Jr. on the financial status of the chapter; a request by attendance chairman J. N. Powell to return attendance cards; an announcement of the March meeting program by Program Chairman J. W. Holland; announcement by A. F. Barnes, member of the Engineers' Council, that the Council will have no symposium this year; a report on the Philadelphia Meeting by Reg. F. Taylor, first vice president of the Society; and a report on the highlights of the Chapters Conference Committee meeting in Philadelphia by Secretary Fleming.

The speaker for the evening was H. W. Newsome, sales engineer, Ingersoll-Rand Co., Houston. He spoke on *The Proper Design and Application of Pumps for Commercial Buildings.* Attendance 56.

• *SOUTHERN CALIFORNIA*—February 21, 1951. Members and guests met for dinner at 7:30 p.m. in the Carolina Pines Restaurant, Los Angeles, and the business meeting was called to order at 8:25 p.m. The meeting was immediately turned over to J. L. McCullough, program chairman, who introduced the speaker of the evening, T. P. Phelan, vice president and secretary of the Los Angeles Stock Exchange. He spoke on *The Securities Exchange and How it Affects your Business.* Mr. Phelan discussed how a Security Exchange operates to stabilize investment procedures and to keep money flowing into the commercial ventures in which we participate. The presentation was well received and was followed by a brief discussion period. The meeting adjourned at 9:45 p.m. Attendance 51. Attendance ratio 0.19.

• *SOUTHWEST TEXAS*—February 20, 1951. An address by J. R. Vernon, sales promotion manager, Johnson Service Co., Milwaukee, Wis., on the subject of the automatic control system keynoted the Chapter's meeting in the Tapestry Room of the St. Anthony Hotel, San Antonio. The address, on a subject of extreme importance to many of the members, was "one of the best talks that the Chapter has ever heard," said Secretary D. E. Locher.

Pres. I. W. Wilke presided over the meeting. Among Chapter business covered was a reminder by Secretary Locher that 1951 dues were due. Attendance 26. Attendance ratio 0.23.

• *WASHINGTON, D. C.*—March 14, 1951. To help give members an opportunity to get to know the next fellow on other than a business basis, the Chapter held a stag in place of its regular meeting. Some played cards, quoits, or other games. Others merely sat around and talked shop. All, however, seemed to have a good time. Secretary I. M. Bortman reported. Attendance 30. Attendance ratio 0.24.

• *WASHINGTON, D. C.*—February 14, 1951. The meeting was called to order by Pres. F. M. Thuney at Naylor's Seafood Restaurant at 8:10 p.m. President Thuney spoke briefly about *All Engineers' Night,* February 23 in the Department of Interior Auditorium and urged all the members to attend this meeting when the entire Registration Committee of the District of Columbia Board of Registration would be on hand to answer any questions about the new Engineers Law or Public Law 789.

S. R. Allen, meetings chairman, introduced the speaker of the evening, R. S. Dill, chief, Heat and Air Conditioning Section, National Bureau of Standards, Washington, D.C., who spoke on *Current Research on Domestic Heating.* Mr. Dill took the members on an *imaginary tour* all over the United States and spoke briefly on the various research projects being carried on at different colleges and universities. Mr. Dill reminded the members that he was vice chairman of the Committee on Research and would welcome any suggestions as to what particular phase of the industry needed research.

Mr. Dill mentioned a project of the *National Warm Air Heating & Air Conditioning Association,* in which a man travels the country in a truck looking into any interesting heating ideas and whenever he finds something which he regards as worthwhile, brings the idea to the association for testing and proving. As an indication of what research has accomplished, the Forest Products Laboratory of Madison, Wis., has proved that moisture in buildings originates in the walls of buildings and not outside of them. He stated that basementless houses are here to stay, and that research has uncovered the proper way to insulate floors in these houses and how to lay ducts to get the best results.

Following the talk, the meeting was turned into an open discussion and the meeting adjourned at 9:00 p.m. after a fine round of applause for Mr. Dill for his interesting presentation. Attendance 50.

• *WESTERN MICHIGAN*—March 12, 1951. After calling the meeting to order, Pres. K. E. Robinson requested the reading of the minutes of the previous meeting and the treasurer's report. It was announced that arrangements were under way for the Chapter's annual meeting, to be held at the Walnut Hills Country Club in East Lansing on May 17.

Informal talks were then given by three of the members on their activities in the heating and ventilating field and a brief history of their background and education was also provided by each speaker. According to the report of Secretary F. W. Brundage these talks were very interesting and should prove to be a most welcome part of each monthly program.

The speaker of the evening was John W. James, chief research engineer, McDonnell & Miller, Inc., Chicago, Ill., who spoke on *Operating Characteristics of Hot Water Heating Systems.* Mr. James' talk

was built around the showing of slides, which illustrated the development of hot water heating systems, starting with the gravity one-pipe system showing the old offset fitting and expansion located in attics. Attendance 77.

• *WESTERN MICHIGAN*—February 12, 1951. The meeting was called to order by Pres. K. E. Robinson, who called on V. H. Hill, chapter vice president, to give a brief report on the activities at the Annual Meeting in Philadelphia. Mr. Hill also stressed the importance of screening the membership carefully for a man who would be eligible for the Chapters Conference Committee for next year. A motion was made and passed to try out at future meetings, informal talks limited to from three to five minutes per member on a short history of his business activities and how he happened to get into the heating and ventilating business. It was felt that this would enable the members to become a little better acquainted.

R. J. Waalkes reported briefly on the Annual Forced Warm Air Short Course scheduled at Michigan State College the week of March 19. The speaker at the banquet, during the Short Course, will be R. L. Towne, sales promotion manager of Rheem Mfg. Co.

The speaker of the evening was E. F. Snyder, Jr., heating engineer, Minneapolis-Honeywell Regulator Co., Minneapolis, who spoke on *Solar Heating*. Slides were shown of various installations of solar heating systems as well as experimental installations. The noticeable feature, according to Mr. Snyder, was that the solar heating system, at least so far, has not been adapted well to the architecture of the structure, due to its bulkiness and the large area required for collecting the heat. Mr. Snyder pointed out that it was not necessarily required that the collecting plates be located in the building to be heated, but could be located nearby, such as near a garage or structure in the rear of the building. The meeting adjourned at 10:00 p.m. Attendance 48.

• *WESTERN NEW YORK*—March 12, 1951. Two interesting sound films, one on the subject of marine boilers and the other on steam boilers, were viewed by the membership at the Chapter's meeting in the University Club, Buffalo. Supplied by the Babcock & Wilcox Co., the first covered all types of marine boilers manufactured by the company and their application to vessels, while the second was given to steam boilers and covered all phases in the manufacture of such equipment, from the planning stage on through to actual installation. On hand from Babcock & Wilcox to run the films and answer questions were C. Lawrence, manager, Marine Boilers, Great Lakes Area, and W. A. Robinson of the Cleveland office.

Pres. J. H. Bryce presided. Attendance 44.

• *WESTERN NEW YORK*—February 12, 1951. Members and guests met at 7:50 p.m. at the University Club, Buffalo, and T. F. Killeen was the presiding officer. Members introduced themselves and their guests and the minutes of the January meeting were read and approved. Q. P. Thompson, delegate to the Technical Societies Council, reported on the civilian defense program and asked for volunteers to act as advisors to the Council. Roswell Farnham gave a brief summary of the 57th Annual Meeting in Philadelphia and announced that Joseph Davis would make a formal report at the March meeting.

Mr. Killeen introduced John Godfrey, of the National Tube Co., Subsidiary of United States Steel Corp. Mr. Godfrey gave a discussion on the reasons that steel is so difficult to obtain today, and showed a motion picture covering the making of steel tubing from the basic ore to the finished product. In general, the picture covered all operations in a modern steel plant where the ore is smelted to obtain the steel, the many steps the steel goes through before the tubes are drawn, and the many steps in the final production of the steel tubing. At the conclusion of his talk a standing vote of thanks was given to Mr. Godfrey for a very interesting and educational presentation. The meeting adjourned at 10:30 p.m. Attendance 30.

• *WISCONSIN*—February 21, 1951. The meeting was a joint meeting with the Milwaukee Section of *ASRE* and dinner was served at 6:30 p.m. in the Engineers' Society of Milwaukee Building. A. C. Topp, chairman of *ASRE*, opened the business meeting at 7:30 p.m. and H. F. Brinen, vice president of the Wisconsin Chapter of ASHVE, reported briefly on the 57th Annual Meeting in Philadelphia.

T. M. Hughey then introduced the speaker of the evening, L. J. DuBois of Westerlin & Campbell Co., Chicago, Ill., who spoke on *Air Conditioning in Large Buildings*. Mr. DuBois mentioned the various meanings of the term *air conditioning*, which often includes the control of a few physical factors, and made specific reference to the development of high velocity air distribution systems in which the air velocity may exceed 4000 fpm. He stated that difficulty with noise at the outlet grille has been largely eliminated with special outlet grilles. In the high velocity air distribution system, consideration must be given to horsepower requirements of the air handling parts.

Mr. DuBois also stated that the type of occupancy in a building affects the most comfortable effective temperature; thus, in a theater, where radiation between people is a factor, a lower effective temperature must be maintained. He pointed out that loss or gain of heat in ductwork is sometimes overlooked in designing equipment and unless properly considered or reduced can result in operating difficulties. A discussion period followed Mr. DuBois' talk, and the meeting adjourned with a rising vote of thanks. Attendance 74.

STUDENT BRANCHES

• *LOUISIANA POLYTECHNIC INSTITUTE*—February 21, 1951. Election of officers was held at the Student Branch's meeting in Bogard Hall at the Institute. Elected were: *president*—W. G. McMullen; *vice president*—V. W. Ashworth; *secretary*—R. L. Gorton; and *treasurer*—B. A. Rose.

Pres. H. A. Parker presided at the meeting which was attended by 10 members. Attendance ratio 0.67.

• *NORTH CAROLINA STATE COLLEGE*—January 22, 1951. Pres. L. R. Wensil called the meeting to order in Page Hall at the College at 7:10 p.m. and V. V. Crews tendered his resignation as Student Branch secretary explaining that outside work made it impossible for him to devote the proper attention to the secretarial duties. F. T. Lathers was nominated and elected to complete the term as secretary. President Wensil discussed the need for volunteers to assist in the preparation of the annual Engineers' Fair.

Prof. C. A. McKeeman introduced the speaker of the evening, Prof. L. L. Vaughan, director of instruction, School of Engineering, North Carolina State College. Professor Vaughan spoke on *Trouble Shooting*, using as a background for his talk two jobs on which he had acted as a consultant. The jobs consisted in: (1) the conversion of a one-pipe hot water system to a one-pipe steam system in a large office building and (2) the analysis of trouble with a high school heating system by investigating the system with the aid of theory as taught in a standard engineering curriculum. Many interesting and enlightening points concerning these jobs were brought out in Professor Vaughan's discussion by blackboard illustrations. In conclusion, he conducted a question and answer period which was very lively and informative. Professor Vaughan then turned the meeting over to Professor McKeeman, who thanked him on behalf of the Student Branch for his appearance on the program. Attendance 30.

• *OKLAHOMA A & M COLLEGE*—March 1, 1951. The meeting was called to order by Pres. R. F. Mossman, and, following the reading and approval of February minutes, two new applicants for membership, Messrs. Carr and Cohen, were introduced. Reports were then given by R. L. Jett, O. A. Brynie and W. E. Suchan.

The speaker of the evening was R. W. Winget of the J. M. O'Connor Co., Tulsa, who spoke on the subject of *Radiant Heating*. Attendance 15. Attendance ratio 0.82.

• *OKLAHOMA A & M*—February 15, 1951. Pres. R. F. Mossman called the meeting to order at 7:00 p.m. and the roll was called, followed by the reading of the minutes of the previous meeting which were approved as read. President Mossman announced that R. W. Winget, engineer with J. M. O'Connor, Tulsa, the guest speaker for the evening, was unable to attend due to the hazardous condition of the roads. Reports were made by the exposition committee, the student council and the treasurer. O. A. Brynie, vice president of the Student Branch, announced that W. J. Collins, Jr., of Collins & Gould, consulting engineers, Oklahoma City, was being contacted to be the guest speaker at a future meeting.

W. E. Suchan, Jr. suggested that the Student Branch have a joint dinner meeting with the Oklahoma and Northeastern Oklahoma Chapters at the College either during or before the Exposition. The meeting was adjourned at 7:40 p.m. Attendance 11. Attendance ratio 0.78.

• *OREGON STATE COLLEGE*—February 15, 1951. The February meeting was called to order by Pres. R. J. Kemper in Dearborn Hall. R. B. Campbell then provided highlights of the Oregon Chapter's February meeting, attended by six student branch members.

The speaker of the evening was K. H. Hanson, sales engineer, Minneapolis-Honeywell Regulator Co., Portland, Ore., who spoke on *The Merits of Sales Engineering*. He gave an outline of his firm's policies toward the college graduate, and then described the sales engineering field. Following Mr. Hanson's talk, J. S. Bowen, Jr., sales engineer for Minneapolis-Honeywell and a recent graduate of OSC, was introduced. Attendance 15. Attendance ratio 0.71.

• *PURDUE UNIVERSITY*—February 21, 1951. Pres. Stanley Kalfus called the meeting to order at 7:00 p.m. in the Mechanical Engineering Building, and the minutes of the previous meeting were read and approved. The new officers were in-

Prof. W. T. Miller with members of the Purdue University Student Branch

troduced and each gave an outline of his plans for the current semester. It was announced that a new membership drive would be started the following week with intentions of recruiting the majority of new members from the lower classmen group, so that each graduation will not practically deplete the membership.

The guest speaker of the evening was Prof. W. T. Miller of Purdue University, who gave a lecture on the various methods of combating moisture in domestic buildings. He illustrated these methods with three glass models, one having a vent at the top, one having a vapor seal, and the other having no protection against moisture. Attendance 23.

• *TEXAS A & M COLLEGE*—February 13, 1951. Pres. J. O. Kadel called the meeting to order at 7:40 p.m. in the Mechanical Engineering Lecture Room and in accordance with the custom of the Student Branch everyone present introduced himself. The minutes of the last meeting were read and approved. J. B. Banowsky and J. A. Olson were elected as the new vice president and treasurer, respectively.

C. P. Howard, graduate student at Texas A & M College, spoke on the *Use of the Network Calculator in Solving Problems in the Design of Air Ducts*. Attendance 15. Attendance ratio 0.63.

• *UNIVERSITY OF TEXAS*—January 16, 1951. Pres. L. E. Scott called the meeting to order in the Engineering Building at 7:00 p.m. and the minutes of the December meeting were read and approved. The election of officers for the 1951 spring semester was held with the following results: *president*—W. A. Cox; *vice president*—J. W. Paxton; *secretary*—M. F. Klevar; and *treasurer*—L. T. Olsen. Mr. Scott spoke briefly concerning the payment of dues by student members and the treasurer gave a brief report.

Movies were shown to the group entitled *The Medical Effects of the Atomic Bomb*, and *Medical Service and Physical Disasters*. Attendance 17. Attendance ratio 0.64.

• *UNIVERSITY OF TORONTO*—February 12, 1951. The meeting was called to order by Pres. H. F. Spragg in the Mechanical Building of the University at 7:45 p.m. The minutes of the last meeting were read and approved.

The speaker of the evening, W. J. Coates, sales engineer, Sarco Canada Ltd., Toronto, Ont., Canada, was introduced and spoke on steam traps in industry, pointing out the chief characteristics of the main types. Mr. Coates used slides to illustrate his talk, which was followed by a short question and answer period. The meeting adjourned at 9:00 p.m. Attendance 21. Attendance ratio 0.41.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month 79 applications for membership, including 16 student applications, 3 reinstatements; and 18 advancements have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by May 30, 1951, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

ALTVATER, H. M., Heating Engr., Watson & Hart, Engrs., Greensboro, N. C. REFERENCES: M. F. DuChateau, P. L. Guest, Jr., J. E. Hart, Harry Hoffman.

AMANN, W. L., Mgr., Air Conditioning Dept., Houston Natural Gas Corp., Houston, Tex. REFERENCES: G. W. Brown, Sr., B. P. Fisher, W. L. Lashley, Jr., D. M. Mills.

ANDERSON, H. E., Pres., H. E. Anderson Heating Corp., Chicago, Ill. REFERENCES: G. W. Bornquist, L. H. Streb, N. W. Swanson, E. R. Teske.

BANKS, W. D., Mgr., Furnace & Sheet Metal Dept., The W. H. Kiefaber Co., Dayton, Ohio. REFERENCES: R. C. Allen, W. R. Budde, W. H. Kiefaber, Jr.*, F. J. Ossenberg.

BITZER, V. R., Sales Mgr., R. D. Bitzer Co., Philadelphia, Pa. REFERENCES: M. E. Barnard, C. J. Forve, G. F. Smith, E. K. Wagner.

BLATZ, R. E., Designing Engr., Radiant Glass and Electric Supply, St. Louis, Mo. REFERENCES: J. T. Lynch, C. O. May, G. B. Rodenheiser, M. D. Rogers, Jr.

BLODGETT, C. W., Estimating Engr., C. W. Johnson, Inc., Chicago, Ill. REFERENCES: G. W. Bornquist, C. W. DeLand, C. W. Johnson, C. M. Vreuls.

BOYETT, T. J., Sales Repr., Jones-Newby Supply Co., Oklahoma City, Okla. REFERENCES: J. H. Carnahan, W. M. Carroll, W. J. Collins, Jr., J. R. Henderson, Sr.

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OBITUARIES

ELLIOTT D. HARRINGTON
Schenectady, N. Y.

E. D. Harrington, head of the defense mobilization activities of the Small and Medium Motor Divisions of the General Electric Co., died suddenly at his home in Schenectady, April 1, 1951, after suffering a heart attack. He was 54.

Mr. Harrington was well known in the electrical industry, having played an important role in General Electric's work in the electrical motor field, and having pioneered in the company's air conditioning and commercial refrigeration activity.

He was recently named to the defense mobilization post in Schenectady, having previously been manager of sales for the Induction Motor Sales Division.

A native of Delavan, Wis., Mr. Harrington was graduated from Beloit College in 1916 and did postgraduate work at Massachusetts Institute of Technology and Harvard University. During World War I he was a pilot and later a gunnery officer in naval aviation.

He joined General Electric in 1919 as a student engineer in the Test Course, and until 1926 was engaged in industrial engineering and industrial control engineering work. He was subsequently assigned to investigate the oil burner field for possibilities in the manufacture of electric control, and recommended that the company enter the oil burner field. He directed the development of the company's automatic oil furnace.

Mr. Harrington subsequently was engaged in the development of other devices, and, in 1932, when the G-E Air Conditioning Department was established, he became commercial engineer. He later was named to a sales executive post and in 1941 was appointed sales manager of the Air Conditioning and Commercial Refrigeration Department, with headquarters at Bloomfield, N. J.

Mr. Harrington then was appointed sales manager of the Schenectady Induction Motor Section in December 1941, and in 1945 became manager of the Induction Motor Division of the former Motor Divisions. Three years later he was named manager of the Induction Motor Sales Division.

Mr. Harrington was a member of the Society for 19 years. He was a member of the Committee on Research in 1936, '37 and '38, and also served on several Technical Advisory Committees during the 30's. He was the author of several papers.

The Officers and Council of the Society extend their sincere sympathy to his wife and two sons.

DR. CHARLES E. LUCKE
New York, N. Y.

Dr. C. E. Lucke, an authority on the subject of thermodynamics and a Life Member of the Society, died March 27, in St. Luke's Hospital, New York City.

Born in New York City, Dr. Lucke received his B.S. from the College of the City of New York in 1895, an M.S. from New York University in 1899, and a Ph. D. from Columbia University in 1902. He became a member of the Columbia staff that same year and remained on the faculty for 39 years, until his retirement in 1941, becoming full professor and head of the department in 1908, and Stevens Institute professor in 1929.

As Stevens professor emeritus of mechanical engineering for a decade, Dr. Lucke continued to give special lectures at Columbia and remained as consultant to a number of business concerns and government agencies as well as the Brookhaven National Laboratory, Atomic Research Commission on Long Island.

Dr. Lucke authored four books and more than 75 papers on the subject of thermodynamics. He was also an authority on internal combustion engines and held 120 patents. His books, considered basic texts, are: *Gas Engine Design*, 1905; *Power*, 1909; *Engineering Thermodynamics*, 1912; and *Heat Transfer Processes and Apparatus*, to be published this year.

During 47 years, Dr. Lucke was also consultant to the United States Department of Agriculture, International Harvester Co., Worthington Pump and Machinery Corp., the New York State Transit Commission, United Aircraft Corp., and the National Advisory Committee for Aeronautics.

Dr. Lucke was elected to the Society in 1924 and became a Life Member in 1946.

The Officers and Council of the Society extend their sincere sympathy to the members of Dr. Lucke's family.

RICHARD H. THOMAS
Hamilton, Ohio

Word has been received of the death of R. H. Thomas, Life Member of the Society, on December 30, 1950. Mr. Thomas was born on Oc-

tober 25, 1863 in Allegheny, Pa., where he attended school.

From 1881 to 1883 Mr. Thomas was employed as a draftsman with H. F. Parker, mechanical engineer, and C. E. Boomer & Bischert Co., New York, N.Y. In 1884 he joined Kelly & Jones, Co., Pittsburgh, Pa., as draftsman and estimator and was superintendent and manager of the Contract Department when he left the firm in 1895. Mr. Thomas was president of Thomas & Smith, Inc., Chicago, Ill., from 1895 until 1915. From that time until the time of his death, he served as president of Economy Pumps, Inc., Hamilton, Ohio.

The Officers and Council of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their sincere sympathy to the members of Mr. Thomas' family.

NELSON B. HUBBARD
Detroit, Mich.

The Society has been informed of the death of N. B. Hubbard on December 31, 1950. Mr. Hubbard was born on March 30, 1886 in Marine City, Mich. and was graduated from Michigan State College in 1909 with a B.S. degree.

From 1910 to 1912 Mr. Hubbard was employed with Lewis & Kitchen, Chicago, Ill., as superintendent of construction and from 1912 to 1915 he was a draftsman with the American Blower Co., Detroit, Mich. From 1917 to 1923 he was employed as an engineer with Mills, Rhines, Bellman & Nardhoff of Toledo, and Smith, Hinchman & Grylls and Geo. D. Mason & Co., both of Detroit. During this time, Mr. Hubbard was engaged in estimating, designing and supervising construction of plumbing and heating systems and in charge of heating and sprinkler work.

In 1923 he set up his own engineering office and from 1926 to 1942 he was a partner in the engineering firm of Hubbard & Wagschal of Detroit. At the time of his death he was engaged in engineering work.

The Society extends its sincere sympathy to the members of Mr. Hubbard's family.

JOSEPH R. DARNELL
Milwaukee, Wis.

Word has been received of the death of J. R. Darnell on January 4, 1951. Mr. Darnell was born on November 16, 1892 at Richmond, Ind., and was graduated from Earlham in 1915 with a B.S. degree.

Mr. Darnell spent two years with the U. S. Bureau of Mines, Pittsburgh, Pa., in the Fuels Section, after which (1920) he joined Sinclair Refrigerating Co. of Chicago, as a combustion engineer. He became associated with the United Machine and Manufacturing Co., Canton, Ohio, as assistant chief engineer in 1924, and in 1926 acted as associate editor of *Power Plant Engineering*, Chicago, Ill. From 1927 to 1933 he was assistant manager of the Mechanical Drafting Department of B. F. Sturtevant Co. and between 1933 and 1946 he was a consulting engineer for Jenkins Petroleum Process and Universal Oil Products Co. He joined Westinghouse Electric Corp. in 1946 and at the termination of his association with Westinghouse was branch manager of the Dallas office.

Mr. Darnell was a member of the *ASME* and a registered professional engineer in the State of Illinois.

The Officers and Council of the Society extend their sincere sympathy to Mr. Darnell's family.

HARRY L. REPP
Lakewood, Ohio

H. L. Repp died in the Lutheran Hospital in Cleveland, Ohio, on January 22, 1951, following a cerebral attack suffered in his home in Lakewood. He was born on March 22, 1880 in Montgomery County, Dayton, Ohio. He attended grade and high school in Dayton and spent two years at Ohio Normal University, Ada, Ohio.

Mr. Repp joined The Geo. Worthington Co. of Cleveland in 1899, where he was engaged in estimating heating jobs; and from 1906 to 1909 was employed with the Novelty Iron Co., Canton, Ohio, in sales estimating and designing heating systems. When he left the Novelty Iron Co., he was employed by Pattison Supply Co. of Cleveland, until 1913, and Pierce, Butler & Pierce, Syracuse, N.Y., in the same capacity. He joined Moline Heat of Moline, Ill., in 1915, as a field engineer. Mr. Repp was associated with the U.S. Radiator Corp. from 1919 until the time of his death, at which time he was branch manager of the Cleveland office.

Mr. Repp is survived by a widow and one daughter, to whom the Officers and Council of the Society extend their sincere sympathy.

DURNO CHAMBERS
New York, N. Y.

Durno Chambers, heating and ventilating engineer, died on February 14, in New York City, at the age of 56.

Born on October 17, 1894, in Newburgh, N.Y., Mr. Chambers received a Ph.B. in mechanical engineering from the Sheffield Scientific School of Yale University in 1916. Upon his graduation, Mr. Chambers became associated with the firm of Walker and Chambers, New York City, as a heating and ventilating engineer. At the time of his death, he was with the Kellex Corp. He was a member of the Society for four years.

He is survived by his wife, daughter, and three sons, to whom the Officers and Council of the Society extend their sincere sympathy.

CARL K. OTIS
Buffalo, N. Y.

C. K. Otis died on March 2 in Buffalo, N. Y. He was a member of the Western New York Chapter and a member of the Society since 1948.

Born in Geneva, Ohio, in 1885, Mr. Otis spent his entire career from 1906 in design, installation and sales of automatic heating, ventilating and air conditioning. From 1937 to the time of his death, he was associated with Joseph Davis, Inc., Buffalo, N. Y., where he was supervisor in charge of engineering for heating and power plant installations.

The Officers and Council of the Society extend their sincere sympathy to Mr. Otis' family.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Headquarters: 51 Madison Ave., New York 10, N. Y. (Tel. Murray Hill 3 0291)

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● **VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. Meets Third Wednesday. PRESIDENT, J. F. Boyenton, 400 W. 24 St., Norfolk 8. SECRETARY, J. E. Harding, Apt. R-2, St. James Terrace, Newport News.

● **WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. PRESIDENT, F. M. Thuney, 1919 K St. N. W., Washington 6. SECRETARY, I. M. Bortman, 422 Luray Pl., N. W., Washington 10.

● **WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, K. E. Robinson, 211 Smith Ave., Lansing 10. SECRETARY, F. W. Brundage, 512 N. Park St., Kalamazoo 11.

● **WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. H. Bryce, 120 W. Tupper St., Buffalo. SECRETARY, C. W. Stone, 503 Franklin St., Buffalo 2.

● **WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, F. J. Nunlist, Jr., 2005 W. Oklahoma Ave., Milwaukee 7. SECRETARY, N. E. Hill, 122 N. Hartwell Ave., Waukesha, Wis.

Student Branches

● **COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Seymour Weinberg, 2147 72nd Street, Brooklyn 4. SECRETARY, Benjamin Karp, 524 Berriman St., Brooklyn 8.

● **LOUISIANA POLYTECHNIC INSTITUTE:** Organized 1949. Headquarters, Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station, Ruston. SECRETARY, R. L. Gorton, Box 184, Tech Station, Ruston.

● **NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, L. R. Wensil, 409 N. Church St., Concord. SECRETARY, F. T. Lathers, 314 Hillsboro St., Raleigh.

● **OKLAHOMA A. & M. COLLEGE:** Organized 1950. Headquarters, Stillwater, Okla. PRESIDENT, R. F. Mossman, 5 Belvoir, Vet Village, Stillwater. SECRETARY, G. J. Martinez, 410 West Elm, Stillwater.

● **OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. J. Kemper, Jr., 645 N. 4th, Corvallis. SECRETARY, J. M. Templer, 720 Kings Rd., Corvallis.

● **PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, Stanley Kalfus, Purdue University, Seneca Dormitory, W. Lafayette. SECRETARY, Miss June Cox, 403 Maple, W. Lafayette, Ind.

● **TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054, College Station, Tex. SECRETARY, W. C. Haggard, Box 5227, College Station.

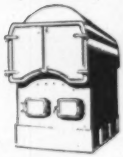
● **UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets, First Tuesday. PRESIDENT, L. M. Blanchette, 2245 Holcomb, Detroit 14. SECRETARY, S. H. Kosinski, 4439-30th, Detroit 10.

● **UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. PRESIDENT, J. L. Williams, 1200 Mississippi, Lawrence, Kans. SECRETARY, R. C. Umholtz, 2732 Michigan St., Topeka, Kans.

● **UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts., Austin. SECRETARY, V. H. Miles, PHP Dorm J, Austin.

● **UNIVERSITY OF TORONTO:** Organized 1951. Headquarters, Toronto, Ont. CHAIRMAN, H. F. Spragg, 35 Harrison Ave., Aurora, Ont. SECRETARY, J. E. G. Blaiklock, 23 Isabella St., Toronto 5, Ont.

Boilers? Sure!! but tanks too!



"No let-down in boiler production insofar as materials permit" is the Fitzgibbons watchword. New large plant facilities and adequate personnel are being *added*, exclusively for defense production. Present facilities suitable only for boiler production and personnel will continue to serve the thousands of builders, architects, heating contractors and jobbers who demand "the best in steel boiler heat" — The Fitzgibbons Boiler.®

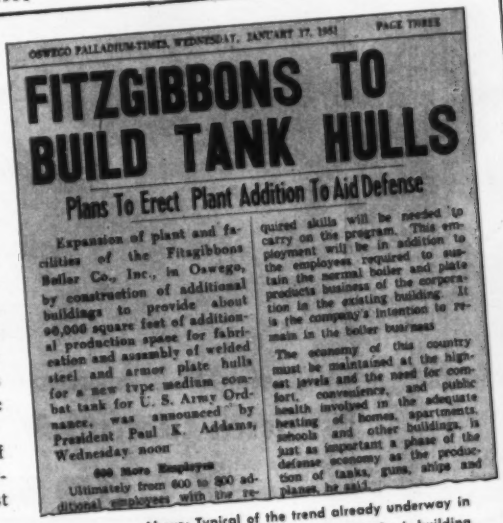
Reprinted from
DOMESTIC ENGINEERING March, 1951

LIMITED PRODUCTION facilities are not likely to be the cause of product shortages in the foreseeable future, according to several prominent manufacturers at the heating and ventilating show last month in Philadelphia.

Fitzgibbons Boiler Company, for example, announced the construction of a new plant to turn out defense orders, and at the same time revealed a determination to use existing facilities as long as possible for the full scale production of civilian lines.

Paul K. Addams, president of Fitzgibbons, told DOMESTIC ENGINEERING that, unlike the last war his company intends to remain in the boiler business.

"The economy of this country must be maintained at the highest levels, and the need for comfort, convenience and public health involved in the adequate heating of homes, apartments, schools and other buildings, is just as important a phase of the defense economy as the production of tanks, guns, ships and planes," Mr. Addams said.



OSWEGO PALLADIUM-TIMES, WEDNESDAY, JANUARY 17, 1951 PAGE THREE

FITZGIBBONS TO BUILD TANK HULLS

Plans To Erect Plant Addition To Aid Defense

Expansion of plant and facilities of the Fitzgibbons Boiler Co., Inc., in Oswego, by construction of additional buildings to provide about 90,000 square feet of additional production space for fabrication and assembly of welded steel and armor plate hulls for a new type medium combat tank for U. S. Army Ordnance, was announced by President Paul K. Addams, Wednesday noon.

400 More Employes

Ultimately from 600 to 800 additional employees with the required skills will be needed to carry on the program. This employment will be in addition to the employees required to sustain the normal boiler and plate products business of the corporation in the existing building. It is the company's intention to remain in the boiler business.

The economy of this country must be maintained at the highest levels and the need for comfort, convenience, and public health involved in the adequate heating of homes, apartments, schools and other buildings, is just as important a phase of the defense economy as the production of tanks, guns, ships and planes, he said.

Above: Typical of the trend already underway in our industry, the Fitzgibbons Boiler Co. is building new production facilities to turn out defense orders. Unlike the last war, this company's existing plant will be devoted to civilian production.

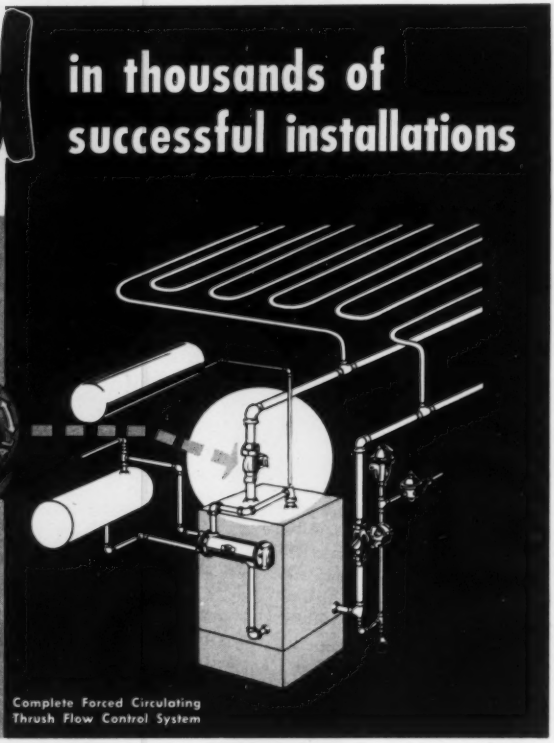
Paul K. Addams, president of Fitzgibbons Boiler Co., and John Collette, are shown with a new gas-fired unit, unveiled for the first time at the Philadelphia show.

Fitzgibbons Boiler Company, Inc.

101 PARK AVENUE, NEW YORK 17, N. Y.

Manufactured at: OSWEGO, N. Y. *Sales Branches in Principal Cities*

Proved in thousands of successful installations



Complete Forced Circulating Thrush Flow Control System

No. 201 Thrush Radiant Heat Control

No. 200 Relay Transformer

Horizontal Thrush Water Circulator

FORCED CIRCULATING FLOW CONTROL HOT WATER HEAT

Keeps air out of Radiant Coils...

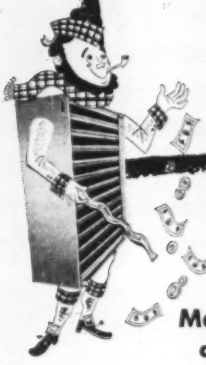
RADIATORS, BASEBOARD AND CONVECTORS

KEEP HOT water heating systems operating at the peak of efficiency by eliminating air at its source. The improved Thrush Flow Control Valve vents air from the boiler. It is really two valves for the price of one because it provides both flow control and air elimination without any extra air tube fitting. Made in the vertical type shown here and also in the angle type to facilitate ease of installation under varying conditions. No other flow control valve has all these features. If you want to give your customers the best in modern radiant hot water heat, specify Thrush Forced Circulating Flow Control System with these valves.

Ask your wholesaler or write Dept. E-5 for bulletin.

H.A. Thrush AND COMPANY
PERU • INDIANA

"MANUFACTURE" FRESH AIR



Save critical material—and money, too!

Make DOREX AIR RECOVERY part of your air conditioning or heating installation

Every ventilation system must supply a certain amount of fresh air to maintain satisfactory air quality within the conditioned space. But air supplied from the outside must be heated or cooled, depending upon the season. Dorex Air Recovery reduces the amount of outside air required for ventilation . . . thus, substantially less heating and cooling equipment is needed, and critical materials are saved.

The thrifty Dorex C Cell is a simple device that "manufactures" *fresh* air from *used* air by passing it through activated carbon — reducing by as much as two-thirds, the amount of outside air that has to be taken into the system.

In dollar savings, this means that every $100 invested in Dorex Air Recovery should save some $400 on original heating and cooling equipment . . . and, in operation, every $1 spent for Dorex maintenance should return a $4 saving in running costs. These are averages based on 20 years' experience and over 7,000 Dorex installations.

Let us show you in detail the dollars-and-sense value — to you and your customers — of Dorex Air Recovery. Mail the coupon today.

DOREX

Air Recovery

W. B. CONNOR ENGINEERING CORP.

Danbury, Connecticut

Air Diffusion • Air Purification • Air Recovery

In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

TRADE MARK "DOREX" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Dept. A-5, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery.

Name .....

Position .....

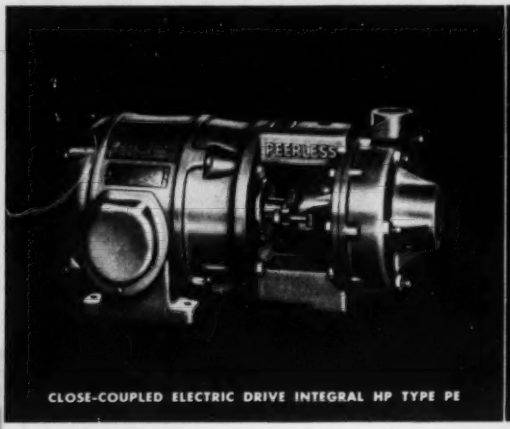
Company .....

Street .....

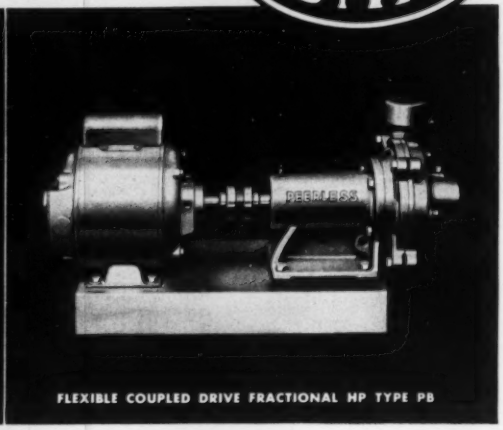
City ..... Zone ..... State .....

CLOSE-COUPLED ELECTRIC, BELTED OR FLEXIBLE COUPLED END-SUCTION PUMPS FOR ALL WATER PUMPING PURPOSES

PEERLESS PUMPS



CLOSE-COUPLED ELECTRIC DRIVE INTEGRAL HP TYPE PE



FLEXIBLE COUPLED DRIVE FRACTIONAL HP TYPE PB

THE PEERLESS *Fluidyne* LINE

IDEAL FOR CONDENSATE WATER PUMPING, EVAPORATIVE COOLERS, HOT OR COLD WATER AND PUMPING OF OTHER CLEAR MILD SOLUTIONS

Now, more than ever, it's important to specify and buy dependable, efficient pumps for both new and replacement services.

And, now from one of the broadest lines of general purpose pumps offered by any manufacturer, you can satisfy your requirements for both peak performance and prompt delivery, in many sizes, with pumps in the versatile Peerless Fluidyne line, illustrated here.

From the Peerless Fluidyne line, two general types of pumps are available. One type is a close-coupled, electric drive pump, designated as the Peerless Type PE; the other is a bracket-mounted pump for flexible-coupled, V- or flat belt pulley drive, designated as the Peerless Type PB.

Both types are economical both in first cost and in service. Both are built for easy maintenance, if service is required. Both are rugged and compact in design. Both are of good design, fitting neatly into any piping and pumping systems. Both embody superior hydraulic characteristics.

Read the specifications at the right. One or several types of Peerless Fluidyne pumps is sure to match your specifications. And delivery is available from two Peerless factories, located at Indianapolis, Indiana and Los Angeles, California.

SIZES:

Type PE HP Range
¼ to 1½ hp fractional hp sizes
2 to 60 hp integral hp sizes

Type PB HP Range
¼ to 1½ hp fractional hp sizes
2 to 150 hp integral hp sizes

CAPACITIES:

Type PE
Up to 65 gpm; fractional hp sizes
Up to 1000 gpm; integral hp sizes

Type PB
Up to 50 gpm; fractional hp sizes
Up to 3500 gpm; integral hp sizes

HEADS:

Type PE
Up to 110 ft.; fractional hp sizes
Up to 200 ft.; integral hp sizes

Type PB
Up to 90 ft.; fractional hp sizes
Up to 260 ft.; integral hp sizes

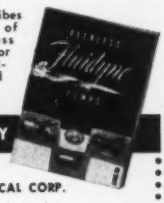
PEERLESS PUMP DIVISION

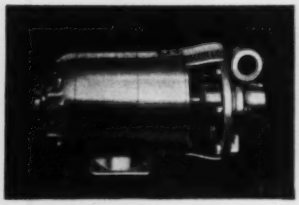
FOOD MACHINERY AND CHEMICAL CORPORATION

Address Inquiries to Factories at:
Los Angeles 31, California or Indianapolis 8, Indiana.
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview, Lubbock, Texas; Albuquerque, New Mexico.

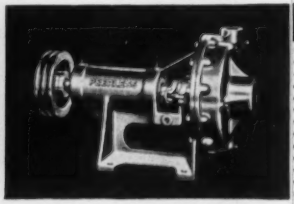
PEERLESS PUMPS fmc

NEW BULLETIN describes additional features of pumps in the Peerless Fluidyne line. Write for your copy of this 24-page fully illustrated and descriptive engineering bulletin today.





Electric drive fractional HP Type PE



V-Belt drive integral HP Type PB

MAIL COUPON TODAY

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORP.
Los Angeles 31, California

Please send me a copy of Peerless Fluidyne Pump Bulletin No. B-2300.

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____

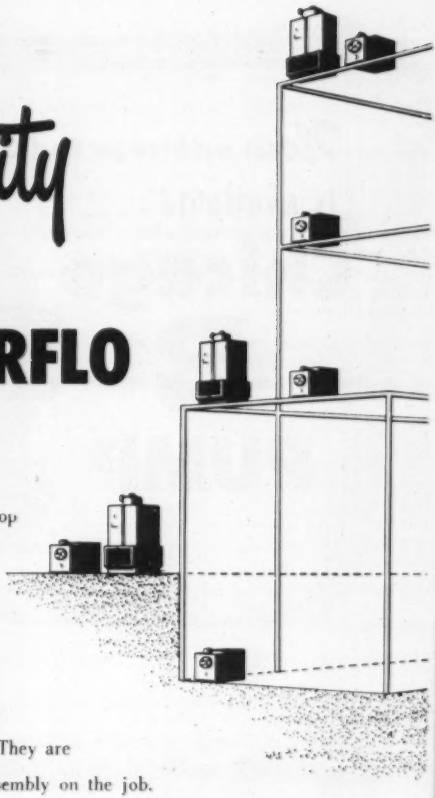
HPAC

any location any capacity

Just name the place . . . and

AQUATOWER or VAIRFLO

will do the water cooling job!

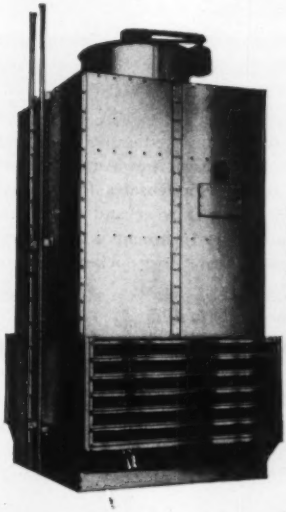


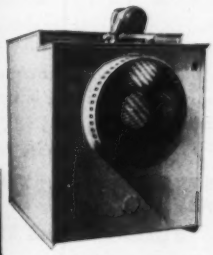
Indoors or out . . . on the ground or on the roof . . . on the top floor or in the basement—*there's a Marley cooling tower designed to fit any location and any cooling requirement.*

If your job is in the 3-ton to 60-ton range, you need an adaptable Aquatower—the compact, trouble-free cooling tower for indoor or outdoor use. Aquatowers are made in nine sizes and two styles to do each specific job economically. They are shipped completely assembled or "knocked-down" for easy assembly on the job.

In larger capacity installations the answer is a versatile Marley Vairflo . . . a broad range cooling tower with all the quality "extras" ordinarily found only in heavy-duty, high priced towers. The Vairflo, in steel or wood, harmonizes with architectural design. All material in Vairflos is completely prefabricated for simple job erection.

Whatever your need, select a Marley tower backed by the Marley guarantee and the "know-how" gained in more than 25 years of leadership in the water cooling industry. For more information, write for Marley bulletins AQ-51 and V-51, or call the Marley representative in your city.





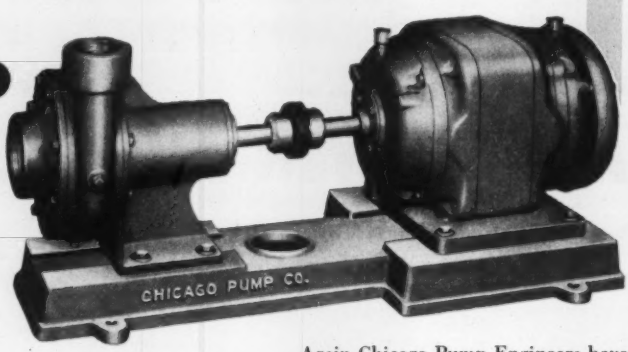
also producers of
DOUBLE-FLOW TOWERS
CONVENTIONAL TOWERS
DRICOOLERS
NATURAL DRAFT TOWERS
SPRAY NOZZLES

The Marley Company, Inc.
KANSAS CITY 15, KANSAS

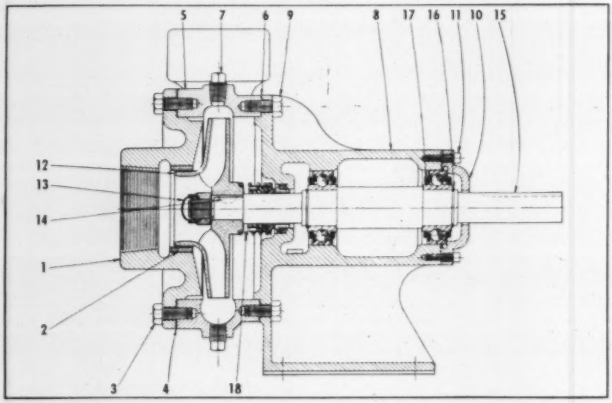
MARLEY

Now a Chicago Pedestal Mounted Side Suction Pump is Available . . .

Chicago B PUMP



Again Chicago Pump Engineers have produced a fine pump. The Chicago B Pump is pedestal mounted, side suction, and is driven through a flexible coupling. Here is a quality pump ruggedly built.



No.	Description	No.	Description
1	Suction Cover	10	Bearing Cap
2	Wearing Ring	11	Socket Hd. Cap Screw
3	Hex. Hd. Cap Screw	12	Impeller
4	Gasket	13	Elastic Cap Stop Nut
5	Volute Casing	14	Woodruff Key
6	Gasket	15	Shaft
7	Pipe Plug	16	Retaining Ring
8	Bearing Bracket	17	Sealed Ball Bearing
9	Hex. Hd. Cap Screw	18	Precision Shaft Seal

MECHANICAL DESCRIPTION

A bronze enclosed impeller is keyed to a sturdy stainless steel shaft. Two heavy duty ball bearings support the shaft. These bearings are lubricated for life. A mechanical seal provides positive insurance against leaking. Pipe discharge sizes are $1\frac{1}{4}$", 2" and 3". The 3" pump has flanged pipe connections. All others have screwed pipe connections. The pump will handle up to 500 G.P.M. and heads up to 215 feet.

SHAFT SEAL Precision built of brass, stainless steel, and neoprene, this high quality mechanical seal insures against leaking. The seal automatically compensates for normal wear on the sealing surfaces. Shaft wear and scoring is eliminated—no maintenance or adjustment is necessary. No expensive piping is needed from drip pocket to drain. No messy floors.

Write for Bulletin 107

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

This Specialty Shop COMBINED Air Conditioning AND Winter Heating AND SAVED 38% by using a DRAVO COUNTERFLO HEATER

It's accepted as a merchandising "must" that better stores today have to provide summer air conditioning for customers as well as winter warmth . . . and the new Bramson Specialty Shop in Evanston, Ill., found a way to do it without the usual high cost and complication.

By using a Dravo Counterflo for winter heating, one set of duct-work serves the year-round, eliminating the cost and complication of a parallel piping system. All equipment is concentrated in a small utility area, readily accessible for adjustment or attention. The complete installation cost $14,000 less than the lowest bid on a wet-type heating system plus equivalent conditioning apparatus . . . a saving of 38%.

During the winter, heated fresh and recirculated air are automatically blended, balancing heat input to heat loss and maintaining selected temperatures in various locations with minimum fuel. In summer, air volume is increased by adjusting vari-pitch sheaves on the blower motor. Because of the stainless steel combustion chamber of the heater, conditioned air can be circulated through the unit without danger of corrosion. The ever-present problem of excess infiltration of air at entrance doors is solved by the use of ducts which discharge heated or cooled air into the entrance area. Aside from turning switches for winter or summer operation, control is completely automatic.

DRAVO
CORPORATION
DRAVO BUILDING, PITTSBURGH 22, PA.

If you have a heating-air conditioning problem, you, too, may find the Dravo Heater an ideal means of reducing installation, operation, and maintenance costs. Ask for a case history describing the Bramson installation in detail . . . and, for full data on the Dravo Counterflo Heater, ask for Bulletin IJ-523-9102.

Dravo also manufactures the *DRAVO CRANE CAB COOLER* for air conditioning hot-metal crane cabs.
PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON
Sales Representatives in Principal Cities. Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec
Export Associates: Lynch, Wilde & Co., Washington 9, D. C.

Bryant Model 304 Gas Forced-Air Vertical Furnace. 6 sizes, inputs from 45,000 to 145,000 Btu per hour. A.G.A. approved for all gases. Features Bryant *Hevigage* 12-gauge steel heat exchanger and Bryant *Push-Button* Ignition (city gases only).

Squeeze-easer

FOR TODAY'S HOUSING

Bryant Gas Forced-Air Vertical Furnaces are *your* answer to the important home space problem. They're the long-lived space-savers that can be installed almost anywhere . . . in basement, utility room or small closet. They require only slightly more than two square feet of floor space in their smaller sizes.

They provide the kind of fully automatic, trouble-free operation that pays off in economy and user satisfaction. The proof is in *thousands* of single-family dwellings and in *thousands* of family units of multi-family housing which have Bryant *Personalized Heating* installations.

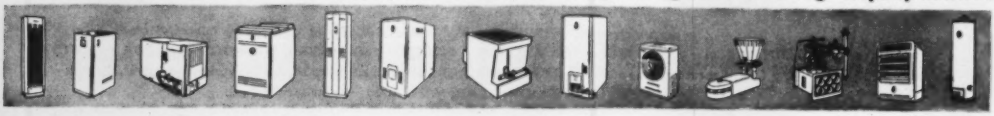
These slim, efficient Bryant Gas Forced-Air Vertical Furnaces will *fit* any new home or replacement heating need. Sell them to help *ease the squeeze* . . . to provide more space for living. Get full details from the Bryant Distributor nearest you or write direct. Bryant Heater Division, Dept. 154, Affiliated Gas Equipment, Inc., 17825 St. Clair Avenue, Cleveland 10, Ohio.

Let the pup be furnace man ...and water boy too!

bryant

AUTOMATIC HEATING

Your *single source* of supply for everything in gas heating equipment!



kno·draft

high pressure air diffusers

NEW...

Space-Saving

Kaufmann's of Pittsburgh uses 3,500 Kno-Draft HPC Air Diffusers. Units are installed 7 feet apart on 7″ x 14″ ducts which are located 20 feet apart and mounted about 9 feet from the floor. In spite of the small, space-saving ductwork, thorough draftless distribution of air is obtained.

Kno-Draft Type HPC High Pressure Air Diffusers are brand-new in principle, but already *proved* in service. Operating at high pressure and velocity, they provide draftless distribution of air to large open areas but require only small, uniform, exposed ducts. As developed for Kaufmann's Department Store in Pittsburgh, the Kno-Draft Type HPC High Pressure Air Diffuser—

1. **Saves** space; uses small, uniform exposed ducts.
2. **Operates** at high pressure and velocity —allows 3000 fpm velocities and 2″ static pressure in ducts.
3. **Achieves** high air induction, draftless distribution—primary air 25° colder than room air.
4. **Provides** complete adjustability to any volume between 90 and 180 cfm, or may be totally shut off.
5. **Functions** perfectly in department store and general office applications.

A new type perforated damper, combined with an interior baffle and jet exit, permits the high pressures and velocities necessary. For a detailed description of the new Kno-Draft Type HPC Air Diffuser—how it works and its application possibilities—mail the coupon today.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
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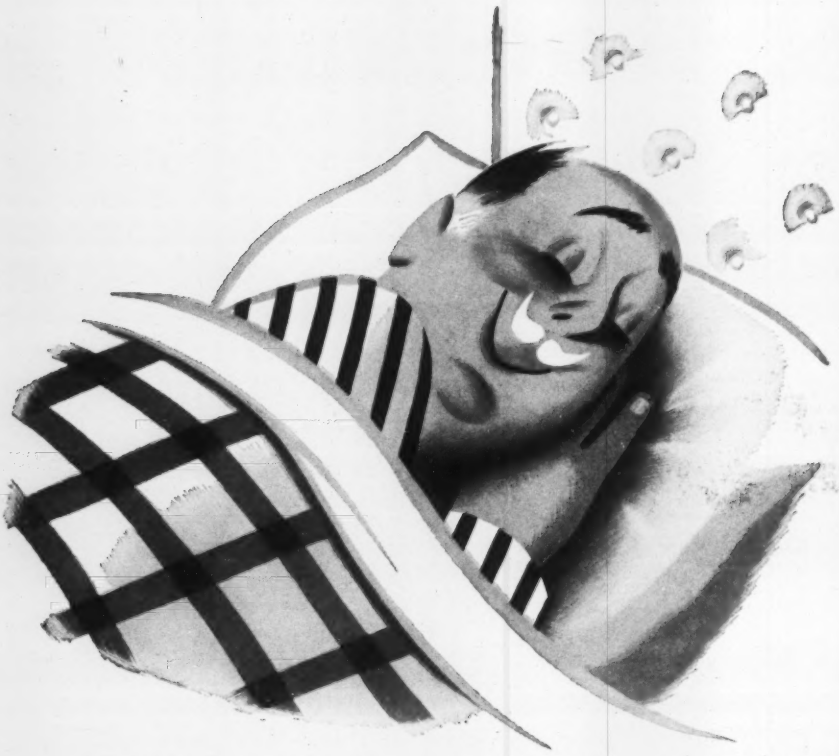
W. B. CONNOR ENGINEERING CORP.
Dept. G-51, Danbury, Connecticut

Please send me, without obligation, Bulletin K-26, which provides full information on the NEW TYPE HPC Kno-Draft Air Diffuser.

Name .....
Position .....
Company .....
Street .....
City ..... Zone ..... State .....



sleep's unaffected...his factory's protected

Worry! Fret! Loss of sleep thinking about fire cutting into production time . . . destroying valuable records . . . costing lives of employees . . . all are anxieties of the past when your factory's protected with modern, approved C-O-TWO Fire Protection Equipment.

For example, the new C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing Systems keynote flexibility to meet your particular fire protection needs. Flammable liquids, electrical equipment, storage and manufacturing processes can all be made firesafe from a single low pressure carbon dioxide storage tank . . . capacities range from one to fifty tons of fire killing carbon dioxide. If fire should strike the fast-acting, non-conducting carbon dioxide extinguishes the blaze in seconds . . . no water damage, no lingering odors.

Further, when a C-O-TWO Smoke or Heat Fire Detecting System is used in combination with a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System, the first trace of smoke or spark of fire in a protected area immediately sounds an alarm . . . then the fire quenching carbon dioxide is readily released into the threatened area.

So, whatever your fire protection problem, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today . . . tell us about your particular fire hazards, our experience is at your disposal . . . no obligation of course.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers • Built-In Smoke and Heat Fire Detecting Systems
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

SPENCER

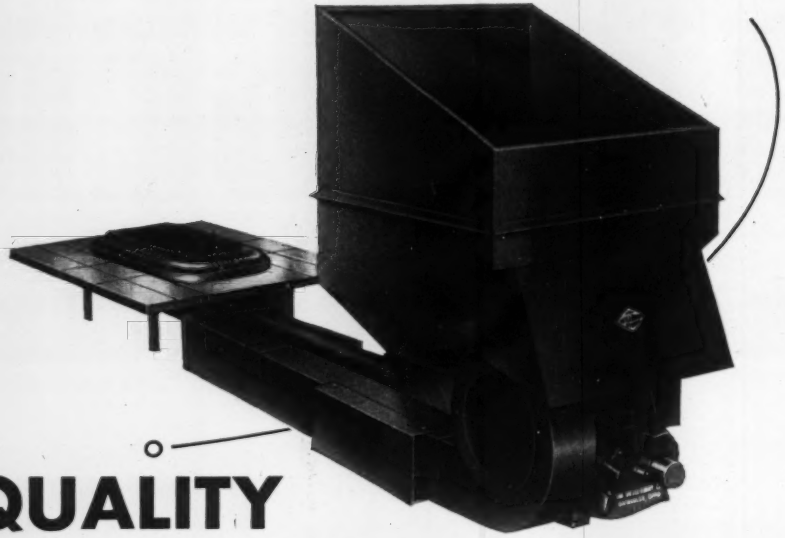
THE QUALITY LINE OF
HEATING BOILERS

VERSATILE—DEPENDABLE

Backed by more than 60 years' leadership

There is a SPENCER for *every* building...for *every* fuel, with capacities from 290 to 45,000 square feet, steam. Precision engineered and manufactured to give superior, *guaranteed* service.

STOKER SALES OFF?
Not Will-Burt!



QUALITY
Makes Sales When Sales Come Hard

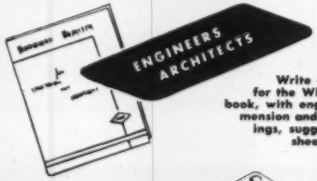
Will-Burt stoker sales are ***up!***

Why? We're carrying on no special promotion — our advertising has not been increased. But for twenty years the knowledge has been spreading that Will-Burt is a good company with which to do business. Ask anyone who has specified, sold or used a Will-Burt stoker. The engineer or architect will say something like this: "Yes, it is accepted without question." The dealer or distributor: "It sells at reasonable prices and our profit isn't eaten up by excessive service calls." The user: "It must be good; we certainly have low coal bills and never any trouble."

Will-Burt stokers have always been designed and built better than the necessities demand.

We have always put ***extra*** quality into Will-Burt stokers, and it is now paying off in increased sales.

If you want to do business with a company whose integrity can never be questioned, whose product is above-average, and who feels business can be pleasurable as well as profitable, drop us a line. ***Now you know*** . . . Will-Burt quality makes sales when sales come hard.



Write on your letterhead for the Will-Burt stoker data book, with engineering facts, dimension and installation drawings, suggested specification sheets, etc. Valuable!

OTHER WILL-BURT HEATING PRODUCTS

Gas and oil conversion burners

Residential hot-water heating boilers

WILL-BURT

THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO

Hint of things to Come?

Who knows what the future will call on you to build? Windowless, air conditioned structures above ground —or *below* ground?

Either way, the techniques York has developed in air conditioning windowless buildings— from the world's first to the world's newest—are freely available to you.

IF WAR SPREADS

You'll also be using air conditioning more and more as a vital production tool. Here again York, headquarters for mechanical cooling since 1885, can save you research and detail—with knowledge gained through years of solving temperature and humidity problems for practically every kind of industry you can name.

IF PEACE PREVAILS

Venture capital will increasingly insist on air conditioning in housing, office and factory construction *and modernization*.

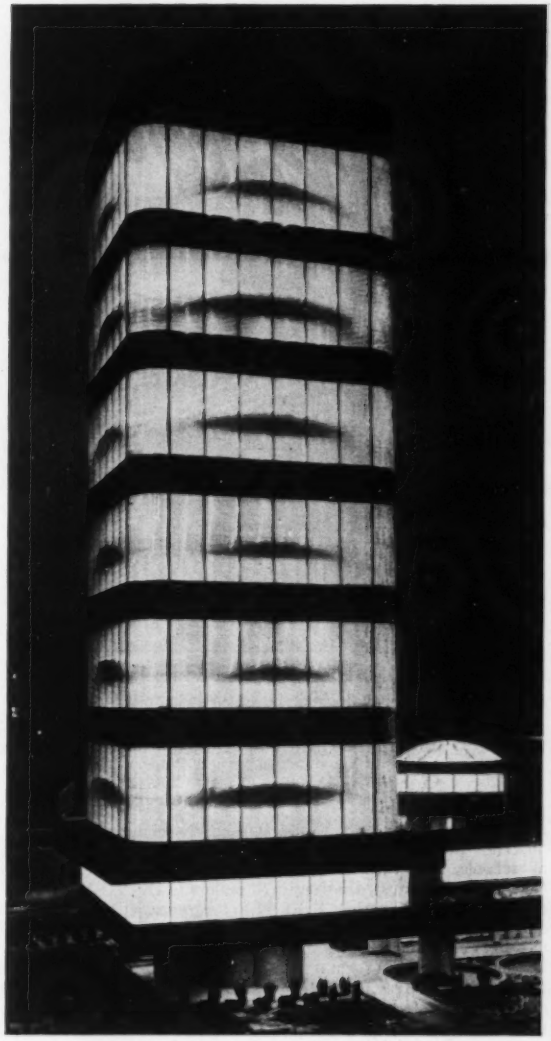
Again you can draw from York's tremendous backlog of experience with the tricky jobs of cooling existing giants like the Empire State Building, Rockefeller Center's Esso Building, F. W. Woolworth headquarters . . . and with the big jobs of weather planning for new projects like Philadelphia's Rittenhouse Apartments, tallest of air conditioned dwellings.

IN EITHER EVENT

Use the lessons we've learned: our nationwide network of trained specialists can help you cut tedious, costly planning and detailing from your work. It's York's policy to channel contract air conditioning through the Architect, Engineer or Contractor. And York relieves you of post-installation responsibility with an exclusive

CERTIFIED MAINTENANCE CONTRACT

that takes all maintenance off your client's shoulders, assures uninterrupted operation for a nominal service fee. Check today with your nearby York Representative or write York Corporation, York, Pennsylvania.



YORK AIR CONDITIONING for a Windowless Wonder

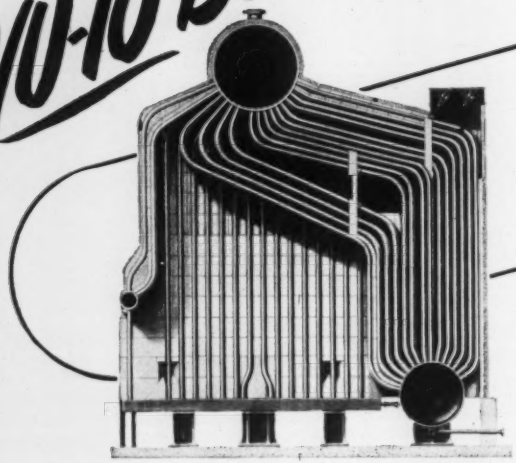
The famed "Heliolab" of S. C. Johnson & Son, Inc., Racine, Wisconsin
Architect: *Frank Lloyd Wright* Resident Engineer: *John Halama*
General Contractors: *Wiltscheck and Nelson, Inc.*
Consulting Mechanical Engineers: *Samuel R. Lewis & Associates*

York refrigeration and air conditioning

The big advances come from YORK

Headquarters for— **Refrigeration and Air Conditioning**

Who Buys VU-10 Boilers?



C-E Vertical-Unit Boiler Type VU-10

The VU-10 Boiler is designed for industrial load conditions and particularly for plants having small operating and maintenance forces. Capacities range from about 10,000 to 60,000 lb per hr. Firing may be by spreader, underfeed or chain grate stokers or by oil or gas burners. Superheater, economizer or air heater surface may be added if desired.

Representative large companies that have purchased VU-10 BOILERS

Air Reduction Company
American Locomotive Co.
Armour & Company
Borg Warner Corporation
Thomas A. Edison, Inc.
Ford Motor Company
Robert Gair Company
General Foods Corporation
B. F. Goodrich Chemical Co.
Illinois Packing Company
Johns-Manville Products Corp.
Jones & Laughlin Steel Co.
Liebmann Breweries, Inc.
Liquid Carbonic Company
National Distillers Chem. Co.
New York Central R.R.
Owens-Illinois Glass Co.
The Pennsylvania Railroad
Remington Arms Company
Revere Copper & Brass Co.
R. J. Reynolds Tobacco Co.
Joseph Schlitz Brewing Co.
Sharpe & Dohme, Inc.
Sunshine Biscuits, Inc.

A quick answer is that VU-10 purchasers include industrials ranging from very small to the largest as well as schools, hospitals, institutions, and, in fact, every type of establishment that requires boilers in the VU-10 capacity range. Why, then, limit the list of representative users shown above to names known to everyone as among the biggest industrial enterprises in the country? Because such names form a significant guide for a prospective boiler buyer, in the same sense that the buying decisions made by operators of large truck fleets can be a reliable guide for the man who wants to buy a single truck.

This reasoning applies *especially* to the purchase of a boiler. Big companies buy boilers frequently . . . therefore their experience is always up to date. They buy them for plants in many locations, using many different fuels. They buy them in capacities from very small to very large. Their requirements justify the employment of highly qualified engineering specialists — both staff men and outside consultants. Thus they have the breadth of experience and the expert guidance requisite to making the soundest equipment selections.

And perhaps equally important, big companies tend to place more emphasis on long-term operating and economic results. They know from their own experience that daily operating economies accruing through the years from better design and construction features will quickly offset the difference in first cost between the cheapest boiler they can buy and the best the market affords.

So if your steam requirements call for boilers in the capacity range from 10,000 to 60,000 lb of steam per hr, we submit the accompanying representative list of large companies that have purchased VU-10 Boilers as a sound reason for confidence that your decision to buy a VU-10 will prove to be a highly profitable one—not only for the first few years of service but throughout the lifetime of the installation.

B-423A

COMBUSTION ENGINEERING—SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Perfect

Wheatland *precision* Couplings

There's no guess work involved in the production of Wheatland *precision* couplings. Modern engineering methods, the skill of experts, years of "know-how" *perfectly* combined, make Wheatland precision couplings measure up high with men who know pipe—and demand the best in couplings.

Help keep America strong and free—get in your scrap now!

precision couplings by

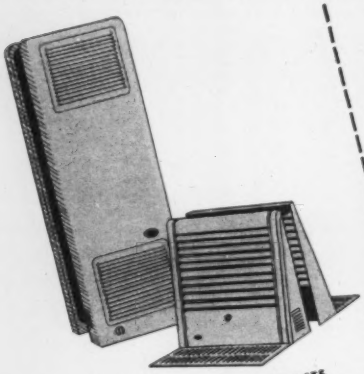
WHEATLAND STEEL PRODUCTS COMPANY

BANKERS SECURITIES BLDG., PHILADELPHIA 7, PA.

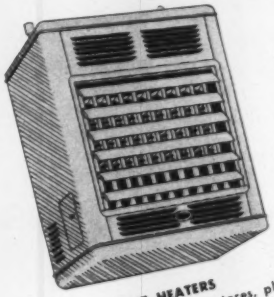
SELL THE COMPLETE LINE

UTILITY

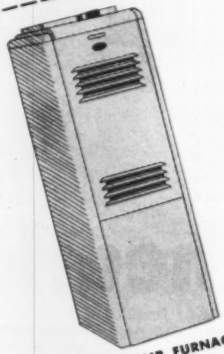
Automatic GAS HEATING Equipment



WALL HEATERS AND FLOOR FURNACES
Ideal for clean, low-cost heat in old or new homes. Will not soil walls.



UNIT HEATERS
Efficient "spot heating" in stores, plants, schools, churches and recreation centers.



FORCED AIR FURNACES
Provide the finest in automatic, quiet, warm-air heat for larger homes, etc.

Guaranteed Heating Performance

UTILITY
TRADE MARK

The Nation's foremost manufacturer of Evaporative Air Coolers . . . Utility Gas Heating Equipment . . . Gaffers & Sattler and Occidental Automatic Gas Ranges.
UTILITY APPLIANCE CORP.
4851 S. Alameda St., Los Angeles 58, Calif.

1. YOU SAVE MONEY

Utility Gas Heating Equipment is soundly engineered and sturdily constructed . . . gives years of satisfactory customer operation . . . is easier to sell . . . service and maintenance are held to the minimum.

2. EXCELLENT PROFITS

The *complete line* of Utility Gas Heating Equipment gives dealers excellent sales opportunities because of the wide spread of Utility products . . . from small to heavy duty models.

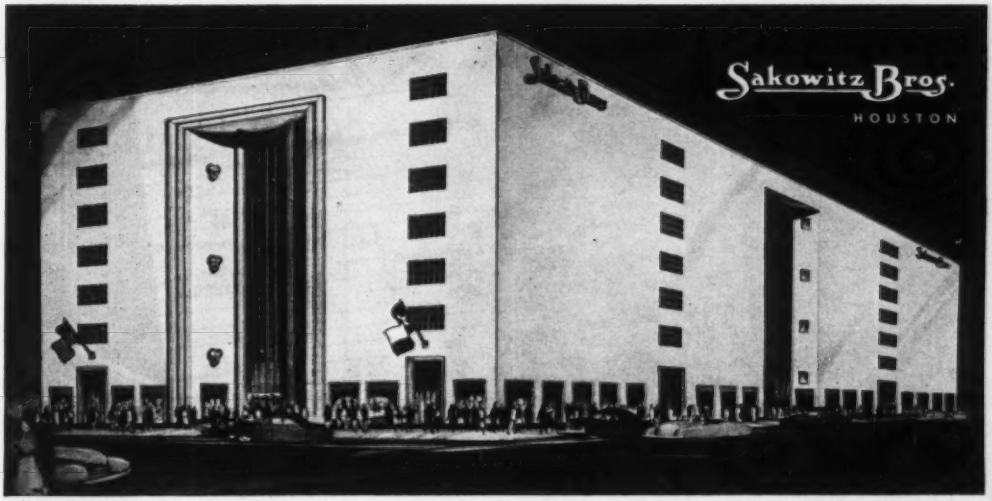
3. ORDER AND YOU'LL RE-ORDER

All Utility Gas Heating Equipment has built-in quality of the highest type, yet selling prices are within limits of modest budgets. Customer satisfaction has resulted in increased dealer volume year after year.

4. ENGINEERING LEADERSHIP

Utility has been the pioneering leader in heating, cooling and ventilating fields of the West for more than a quarter-century. Utility products are preeminent . . . meet A.G.A. requirements.

For year-'round business, handle UTILITY COOLING, too!

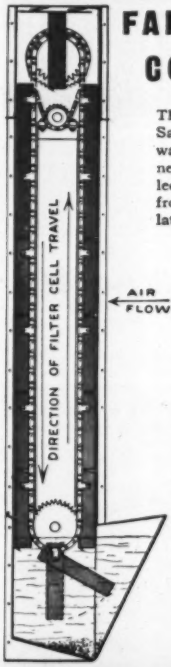


REG. F. TAYLOR, Houston, Texas, Consulting Engineer

STRAUS-FRANK CO., Houston, Texas, Contractors

FAMOUS HOUSTON DEPARTMENT STORE SELECTS CONTINENTAL AIR FILTERS FOR NEW BUILDING

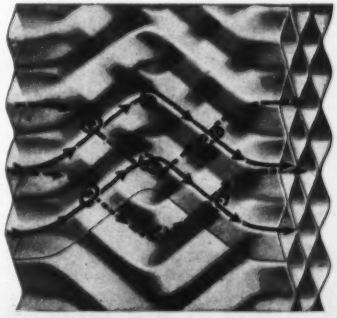
The huge, modern, fully air-conditioned building of Sakowitz Bros., leading Houston department store, was opened for business February 19, 1951. Continental Automatic Self-Cleaning Air Filters were selected, after careful consideration, to extract the dust from the tremendous volume of air constantly circulated throughout this large and busy store.



Left: Cutaway view of filter unit (listed by Underwriters' Laboratories, Inc.) showing filter cell Ferris Wheel rotating action and self-cleaning oil bath action.

AIR FLOW

Below: Cross-section diagram of patented Filter Media showing turbulent air flow, which results in extremely high air-cleaning efficiency (91.5% by A. S. H. V. E. method), and exceptionally low resistance.



Check Continental Air Filters for your air-cleaning problems, and you'll recognize their superiority. Continental's revolutionary, *patented filter media* extracts air-borne dust more efficiently with *constant* low resistance to air flow. *Filter cells pivot* like cars on a ferris wheel as they pass from the front to the back filter curtain. There is no reversal in the direction of air flow through the filter media. As a result, dirt cannot be blown off into the clean-air stream. And, filter cells are kept clean with . . .

AUTOMATIC SELF-CLEANING ACTION

For 30 minutes or more each filter cell soaks in the oil reservoir in a semi-horizontal position. Then the cell drops to a vertical position . . . thus causing the resultant surge of oil to pass through and effectively flush each air passage. The entire air filter operation provides minimum air resistance and maximum air cleaning efficiency.

WRITE FOR PERFORMANCE DETAILS

Before you specify or buy, ask us for complete performance data on Continental Automatic Self-Cleaning Air Filters. Use the coupon. No obligation.

GENTLEMEN: Please send the following:

☐ Bulletin No. 201-C

☐ Sample of Eswash Air Filter Media

NAME_____

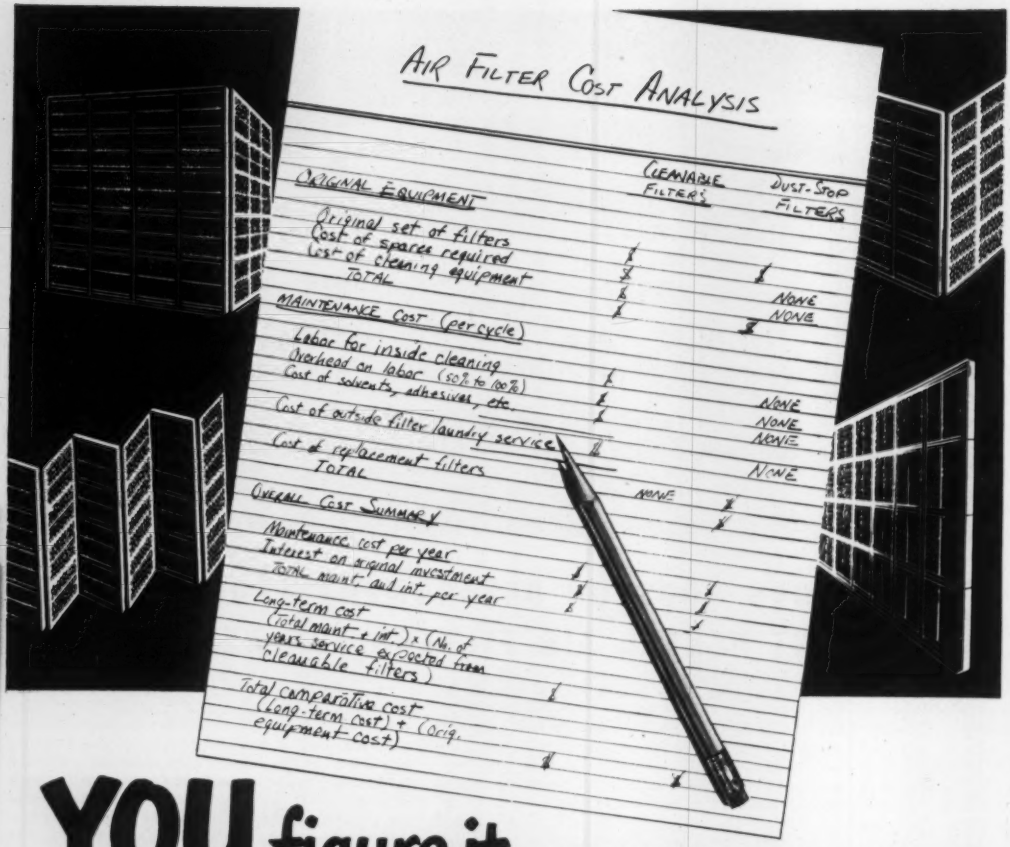
FIRM_____

STREET_____

CITY_____ STATE_____

CONTINENTAL AIR FILTERS, Inc.

P. O. BOX 1647 • LOUISVILLE 1, KY.



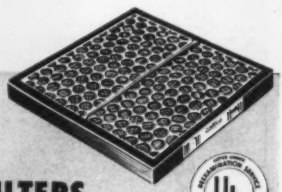
YOU figure it... (4 TO 1, WE'LL SAVE YOU MONEY)

Do you really know which costs you less—cleanable air filters or Dust-Stop replacement-type filters? It's easy to figure out, using the method shown above and *your own cost figures.* Chances are about 4 to 1 that you'll save with new Fiberglas Dust-Stop* Air Filters.

You see, while rising labor costs have made filter cleaning more expensive, mass production has lowered the cost of Dust-Stop Filters. In fact, on the basis of one 40c cleaning every 90 days, cleanable filters would have to last up to 14 years to match the cost of Dust-Stop Filters replaced at the same intervals.

Owens-Corning Fiberglas Corporation, Dept. 40-E, Toledo 1, Ohio.

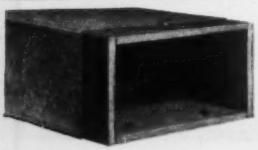
The "Comparative Study of Air Filtering Costs" contains facts, figures, and charts important to anyone interested in air conditioning. A copy free on request. Write today.



OWENS-CORNING FIBERGLAS

DUST-STOP* AIR FILTERS

*T. M. REG. U. S. PAT. OFF.

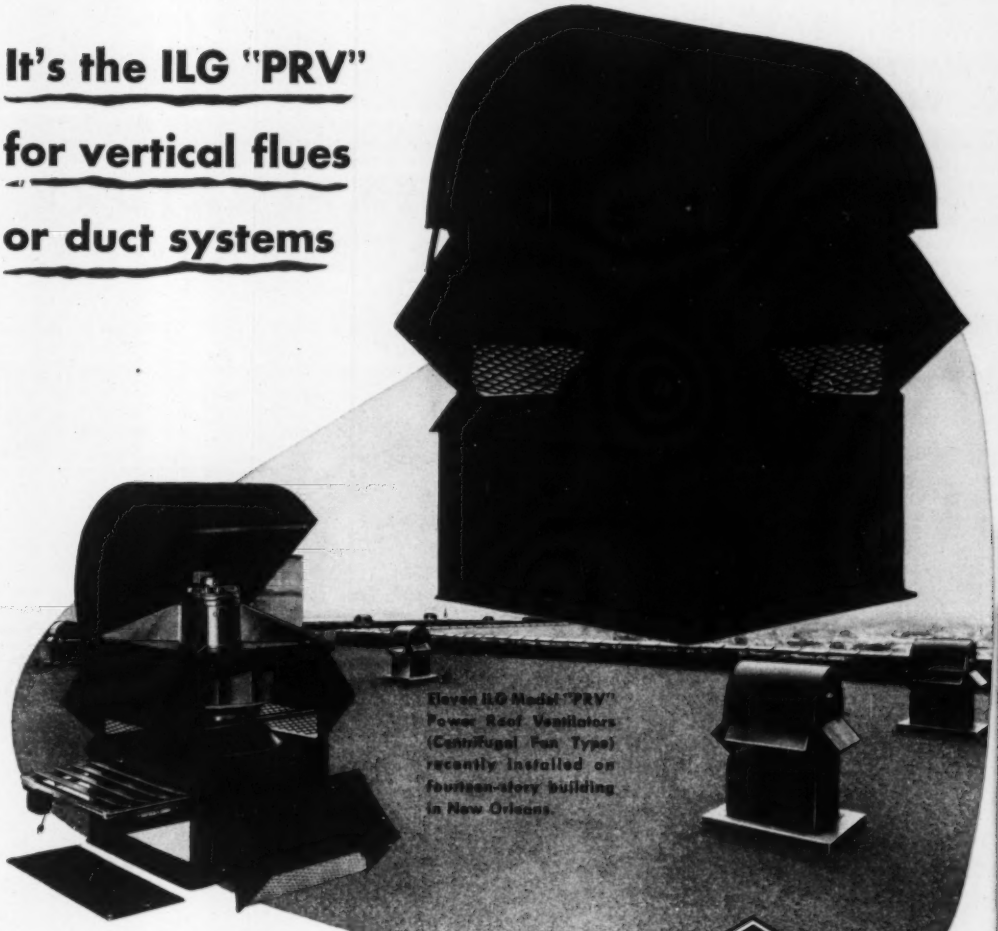


FIBERGLAS INSULATION FOR AIR DUCTS

Ageless, light in weight, firesafe, moisture resistant, Fiberglas Duct Insulations can be easily applied . . . have very high acoustical value . . . won't erode at 6,000 fpm . . . cost less than other insulations approaching them in thermal efficiency. Write for details.

*DUST-STOP is the trade-mark of Owens-Corning Fiberglas Corporation for impingement-type air filters made of glass fibers. FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

It's the ILG "PRV" for vertical flues or duct systems



Eleven ILG Model "PRV" Power Roof Ventilators (Centrifugal Fan Type) recently installed on fourteen-story building in New Orleans.

New, improved power roof ventilator

● If you haven't given consideration as yet to this new ILG Model "PRV" Power Roof Ventilator for tough ventilating applications, you are missing the biggest development in years! Architects and engineers have given the unit a rousing welcome . . . they tell us it has every desirable feature for positive, controlled ventilation, independent of wind and weather conditions. They like the design—a complete ventilating unit consisting of a self-cooled motor direct-connected to a non-overloading, backward curved wheel, plus a selection of air control accessories in a single, weathertight housing. They approve its rugged construction, its precision manufacture. They find the sizes are right to give exceptional air deliveries over a wide range of pressures (free air to 1½" SP). And they bank on ILG's "One-Name-Plate" Guarantee. To get the complete story, call nearby Branch Office (consult classified directory) or send coupon today.

ILG

VENTILATION

Free! New engineering data bulletin No. 1901 gives you the complete story—features, sizes, capacities, dimensions. Send coupon now!

☐ Send free bulletin No. 1901.

*Firm Name*_____

*Individual*_____ *Title*_____

*Address*_____ *Zone*_____

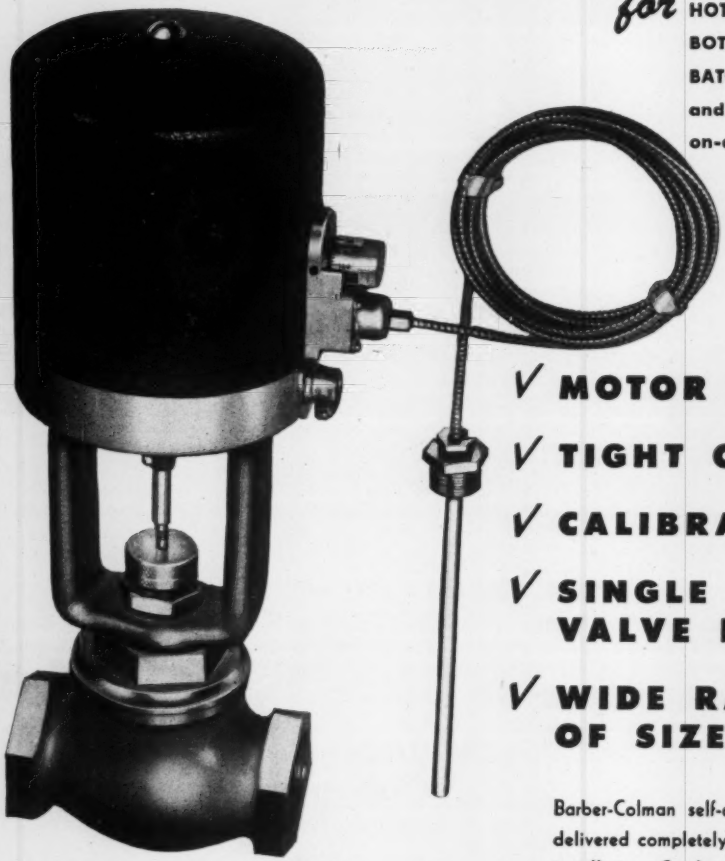
*City*_____ *State*_____

ELECTRICALLY OPERATED

BARBER COLMAN

TEMPERATURE REGULATORS

for HOT WATER STORAGE TANKS
BOTTLE WASHERS
BATCH KETTLES
and other two-position on-off applications



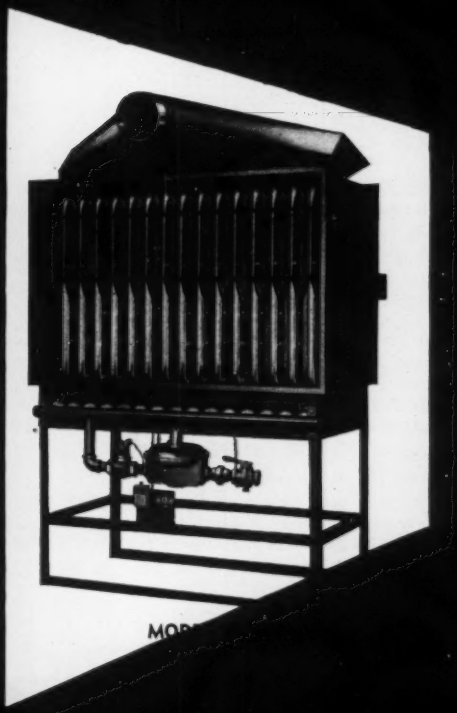
- ✓ MOTOR OPERATED
- ✓ TIGHT CLOSING
- ✓ CALIBRATED DIALS
- ✓ SINGLE SEAT VALVE BODIES
- ✓ WIDE RANGE OF SIZES

Barber-Colman self-contained regulators are delivered completely assembled, ready for installation. Can be connected direct to 60 cycle A.C., 115 or 230 volt, as specified.

Write for Literature
Ask for Bulletin F-4695

BARBER-COLMAN COMPANY
1228 ROCK STREET • ROCKFORD, ILLINOIS

BARBER COLMAN



some fellows are just never content

You know the type . . . they keep fussing with, working on, and solving problems that seem impossible to most people.

Time was, when many folks in air conditioning thought that the pumps used to recirculate cooling water in air conditioning systems were pretty good. And when compared, pump for pump, this was true. Yet the fellows in the I-R laboratories weren't content. They figured that if they could make a *1½ H.P.* pump do the same work as an ordinary *2 H.P.* pump, they'd have something really special to offer. First cost would be lower, there would be a saving on space and weight and, more important, installations wouldn't be as expensive.

So I-R engineers worked on this idea; and when they informed us they had succeeded, we wanted proof. Then they told us about "an impeller of new hydraulic design," "extra heavy shafts designed for a maximum deflection of .001 inch," etc. But most important, they produced a line of Ingersoll-Rand MOTORPUMPS that proved to be tops in efficiency and reliability when compared size for size with *any* other type pump on air conditioning systems today!

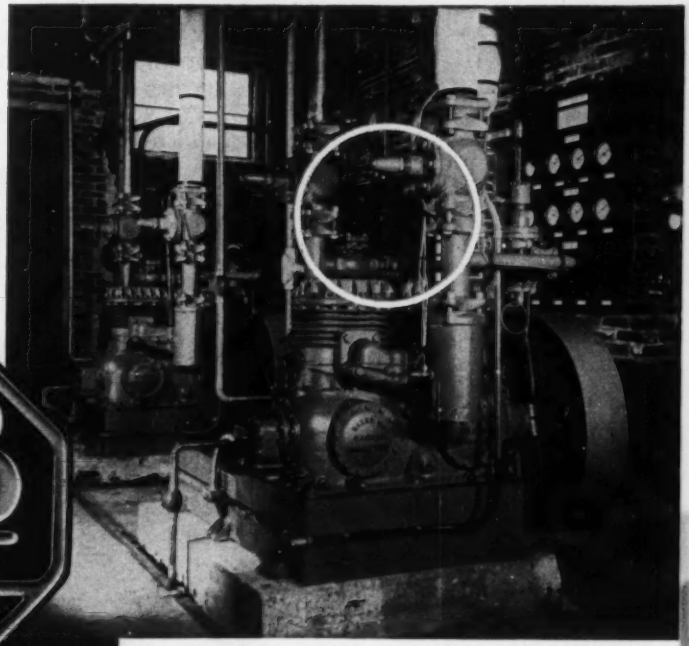
This remarkably efficient I-R MOTORPUMP had a terrific impact on the air conditioning industry. For not only did it offer folks like yourself a way to recirculate cooling water with a smaller pump, but it was made readily available . . . right out of warehouses across the country. And these same warehouses offer service on all I-R MOTORPUMPS installed. Your nearest I-R distributor or representative has the facts and figures . . . call him in now, or write us for descriptive literature. Ingersoll-Rand Company, 11 Broadway, New York 4, New York.

Ingersoll-Rand

90 years of BIG PUMP know how packed into **small pumps** for air conditioning applications

MOTORPUMP

617-9



Baker compressor units, equipped with Allen-Bradley motor starters, installed in Westmont Theater, Philadelphia, Pa.

A-B Quality

BAKER COMPRESSOR UNITS *equipped with* ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Why are Allen-Bradley starters so popular for refrigeration and air conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

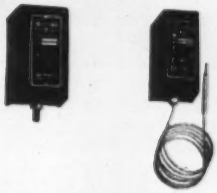
Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

Typical Refrigeration Controls

PRESSURE AND TEMPERATURE CONTROLS



A-B Bulletin 836 pressure control and A-B Bulletin 837 temperature control. Accurate, rugged, compact units.

AUTOMATIC STARTER

A-B Bulletin 709 solenoid starter. Note white interior for ease of wiring.

COMBINATION STARTER

A-B Bulletin 712 disconnect switch type combination starter. Saves installation time.

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

ARE YOU WORKING ON ANY PROBLEMS INVOLVING THE INSULATION OF PIPES? LET THIS HELPFUL FACT FINDER GIVE YOU...

...Btu Loss
...Surface Temperature
...Efficiency of

FIND THE FACTS ABOUT

2 GREAT PIPE INSULATIONS

UNIBESTOS No. 750
—for temperatures up to 750° F.
UNIBESTOS No. 1200
—for temperatures up to 1200° F.

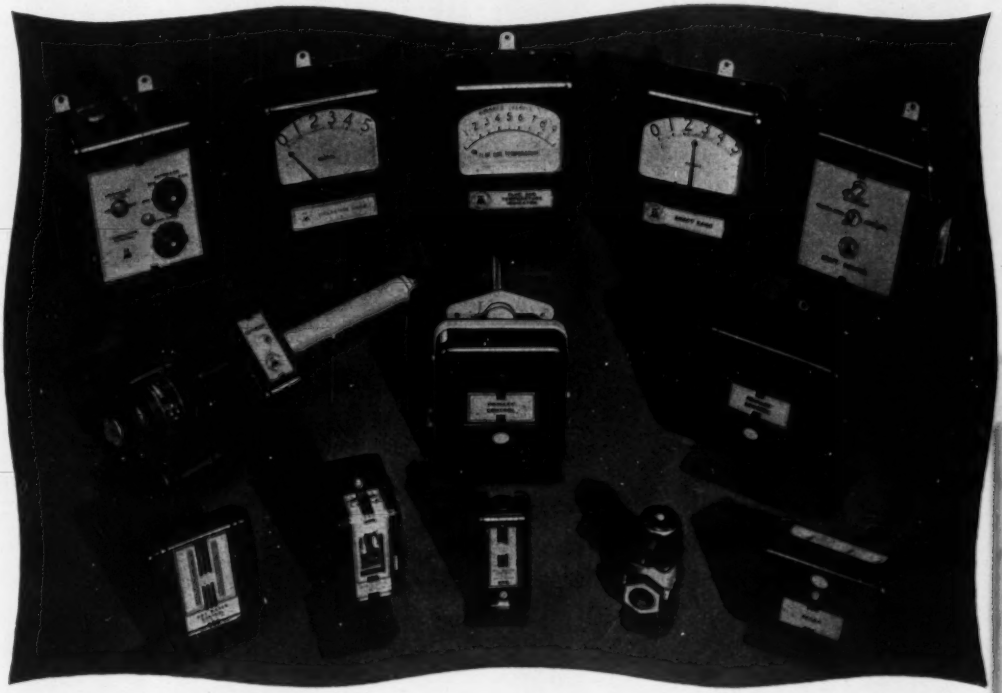
UNARCO

WRITE today, on your company letterhead, giving your title or function. A "Fact Finder" will be sent to you together with complete information on UNIBESTOS Pipe Insulations No. 750 and No. 1200.

UNION ASBESTOS & RUBBER COMPANY

DEPT. 1819A • 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

Save **FUEL!** Save **MONEY!** Save **TIME!**
with a modern draft control system



Stretch your fuel supply and pay for your Perfex Draft Control system with the resultant savings. This draft control system will help you get more out of your equipment and fuel and cut down on your operating costs.

Here's how the Perfex Draft Control system works . . . *and why it saves:*

1. Controls draft in the firebox during "Off" periods . . . *prevents excessive stack losses, and provides more efficient heat transfer.*
2. Opens damper before re-starting burner . . . *provides safe starting conditions.*
3. Switches to automatic draft control during burner operation . . . *maintains constant draft in firebox and assures more efficient burner adjustments.*

Perfex Draft Control systems are available in sets for gas, oil, or stoker-fired equipment. Send coupon or write us today for further information.

FREE! Complete diagrams, layouts, specifications on Perfex Draft Control Systems. No obligation!

PASTE ON PENNY POSTCARD AND MAIL TODAY

☐ Have distributor make heat survey

☐ Send free bulletins on Perfex Draft Control Systems for ☐ Gas ☐ Oil ☐ Stokers

Firm Name_____

Individual_____ Title_____

Street_____

City_____ State_____

PERFEX

CONTROLS YOU CAN TRUST

PERFEX CORPORATION, MILWAUKEE, WISCONSIN
In Canada, Perfex Controls Ltd., Guelph, Toronto 1

Heating?

Cooling?

Air Conditioning?

Process?

Here's How to Get the RIGHT Answer to your HEAT-EXCHANGE PROBLEMS

The right ratio of surfaces – the right materials – the right velocities – the right proportion between coil area and depth . . . there are dozens of factors that affect the efficiency, maintenance and service life of heat-exchange coils.

For best performance in your own application, the practical approach is to take full advantage of the unequalled engineering, research and design skill – the unequalled manufacturing and testing facilities – which Aerofin offers you.

To get the *right* answer – ask the Aerofin man.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

AEROFIN CORPORATION

410 South Geddes St. SYRACUSE 1, N. Y.

NEW YORK • BOSTON • CHICAGO • CLEVELAND • DETROIT • PHILADELPHIA • DALLAS
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KAYLO HEAT INSULATION

...Easy to Handle and Apply

Kaylo Heat Insulation is easy to handle and apply—in all sizes, shapes and thicknesses—because of its high structural strength and light weight. This remarkable combination of high strength and light weight makes possible speedier application. It provides for units of greater size which permit larger surfaces to be covered faster. With these combined features, Kaylo Heat Insulation gives exceptional ease of handling—offers substantial savings in application costs.

Kaylo Heat Insulation is a hydrous calcium silicate (not glass) with a wide effective temperature range—up to 1200°F. It is inorganic and insoluble in water, incombustible and retains its dimensional stability in long service under severe conditions.

KAYLO PIPE INSULATION is made to Simplified Dimensional Standards of thicknesses and diameters. Coverings are sectional for tube and pipe sizes ¼″ to 12″; tri-segmental up to 23″; quad-segmental up to 41″; K-segmental (18″ wide segments) up to 72″ in diameter.

KAYLO HEAT INSULATING BLOCK is made in all standard sizes and thicknesses from 1″ to 6″ for flat surfaces and for vessels larger than 60′ in diameter; curved block 18″ wide for smaller vessels.

SEND OUR CATALOG

For complete details on Kaylo Heat Insulation, write Dept. N-197, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

KAYLO®

...first in calcium silicate

...pioneered by OWENS ILLINOIS Glass Company

MAIN OFFICE: Toledo 1, Ohio — KAYLO SALES OFFICES: Atlanta · Boston · Buffalo · Chicago · Cincinnati · Cleveland · Detroit Houston · Minneapolis · New York · Oklahoma City · Philadelphia · Pittsburgh · St. Louis · Washington

PRODUCT PERFORMANCE

with

Improve

SEALMASTER
BALL BEARING UNITS

SEALMASTER Ball Bearing Pillow Block Unit. Other SEALMASTER units include Cartridge Units, Take-Up Units, Flange Units and Flange-Cartridge Units

1 Smooth, Quiet Operation

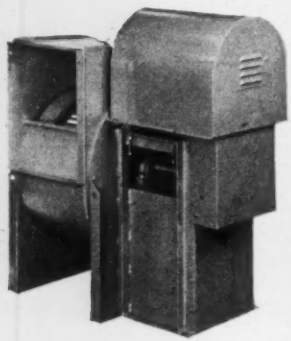
2 Minimum Maintenance

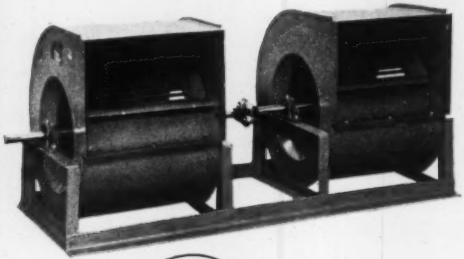
3 Fast, Simple Installation

4 Dependable, Long-term Service

Manufacturers are finding through experience that SEALMASTER Ball Bearing Units definitely improve the performance of their products and give greater customer satisfaction. You'll soon discover that SEALMASTER units set new high standards of bearing efficiency and economy. Write us and request a copy of catalog 845 for your files . . . it gives the complete SEALMASTER story.

☆ PERMANENTLY SEALED ☆ SELF-ALIGNING
☆ PRE-LUBRICATED ☆ NO HOUSING WEAR





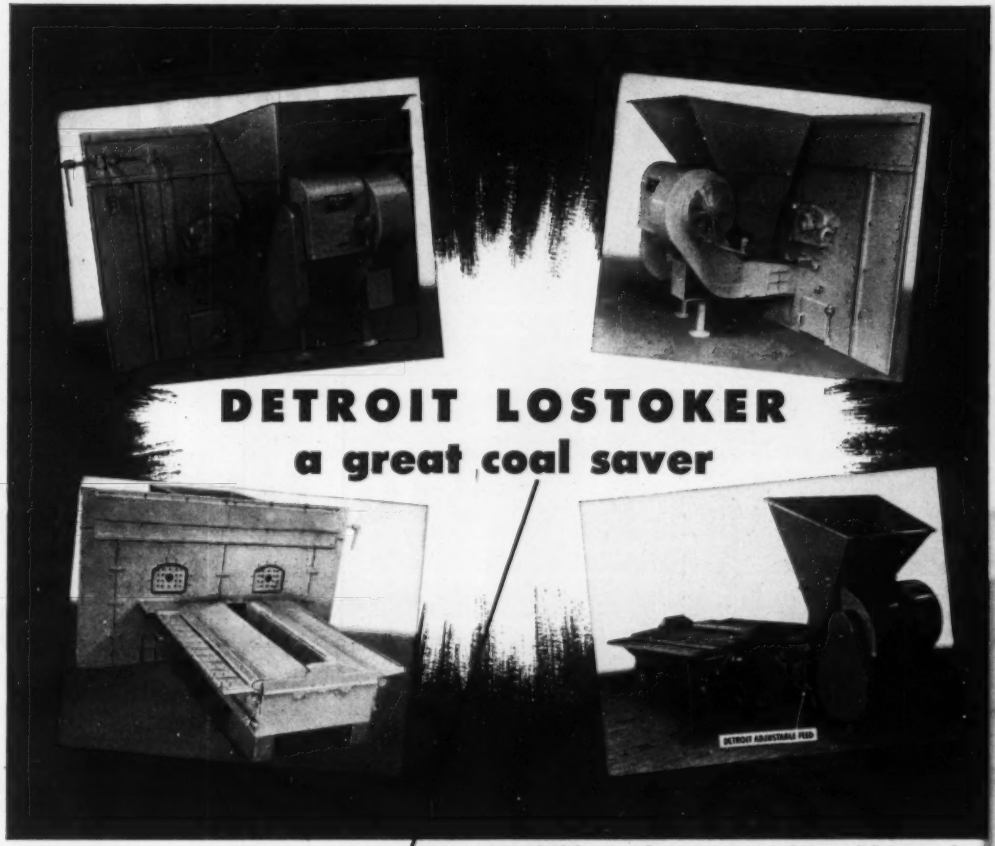
Master Fan units equipped with SEALMASTER bearings. Photos courtesy of Master Fan Corporation, Los Angeles, Calif.

BEARING DIVISION

STEPHEN S-A ADAMSON MFG CO.

47 RIDGEWAY AVENUE, AURORA, ILLINOIS LOS ANGELES, CALIF. ★ BELLEVILLE, ONT

Factory Representatives and Dealers in All Principal Cities



Now Available with Detroit Adjustable Feed
(Coal Feed Control)

The Detroit LoStoker is a complete firing unit. Compact —single retort—mechanically driven—plunger feed—side cleaning design. Many sizes and capacities for various types of boilers. Simple, accessible, dependable. Thousands in daily use.

Now the LoStoker is available with the *Detroit Adjustable Feed,* a reliable automatic coal feed control. It regulates the fuel supply according to the load when connected to a Master Regulator which also controls the air.

Coal and air are thus proportionately varied for maximum efficiency at all capacities.

The new type *Hi-Tuyeres* supply more air per square foot of grate and reduce coking tendency and decrease the combustible in the ash. Standard on all new stokers, Hi-Tuyeres are also available for present installations.

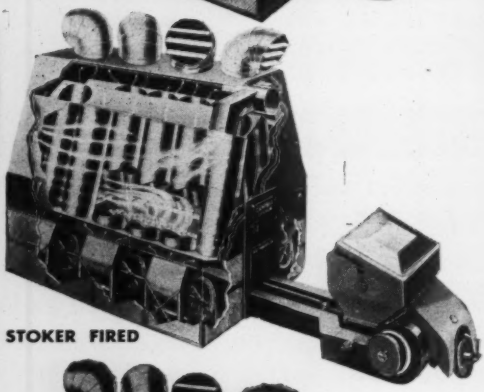
LoStokers are popular with engineers because they are dependable, easy to operate. Write for catalog. No obligation.

SINCE 1898

There is a Type and Size of Detroit Stoker for every Industrial and Power need!

DETROIT STOKER COMPANY
General Motors Building — Detroit 2, Michigan
District Offices in Principal Cities • Works at Monroe, Michigan

OIL FIRED



STOKER FIRED

GAS FIRED

Campbell SPACE HEATERS *for* BIG JOBS

For easy installation, exceptional fuel economy and long, dependable service, specify CAMPBELL for your next large space heating job. Built in capacities up to 2,160,000 BTUs, these Campbell space heaters are available for all fuels. These heaters can be shipped as a complete unit, ready to connect to fuel line, electric power and flue. Or, where necessary, they can be shipped in sections for assembling and welding on the job.

We also build direct oil and gas-fired heaters for drying and processing operations, up to 14,000,000 B.T.U.'s.

WRITE: We will be glad to provide layouts, sketches or suggestions on any large space heating installation. Send us your specifications and details.

CAMPBELL HEATING COMPANY

3143 Dean Avenue • Des Moines 17, Iowa

Tri-Flex Aerovane ..in the First National Bank of Tulsa

The selection of the distribution equipment for an air conditioning system depends on just two factors . . . performance . . . appearance. And two good reasons indeed why in Tulsa's beautiful new First National Bank Building there was no question about the choice of grilles and registers . . . Tri-Flex for supply . . . Aerovane for return. Unmatched in performance . . . maximum flexibility to meet the most rigid requirements of air delivery. Unmatched in appearance . . . styled to harmonize with whatever the interior design or decor may be. When you specify Tri-Flex and Aerovane, you can be sure of the results.

TUTTLE & BAILEY INC

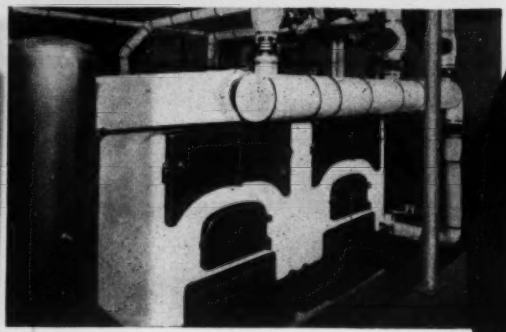
Engineered Products for Air Conditioning, Heating and Ventilating

NEW BRITAIN, CONNECTICUT

4TB51

AMERICAN-Standard

First in heating...first in plumbing



13 AMERICAN-Standard WATER TUBE BOILERS heat 276 unit project

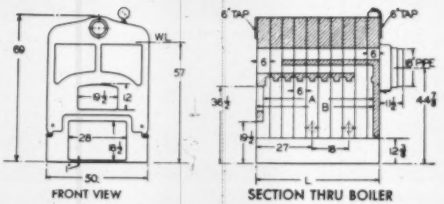
● One of the Northwest's finest court-type housing projects is Portland's attractive Binford. Privately owned by Mr. L. C. Binford, this 276 unit residential community is as modern as you'll find anywhere. And, of course, American-Standard products play an important role in keeping it so!

The entire heating system of this large project is dependably fired by 13 oil fired No. 36 Water Tube Boilers. Installed in most instances in batteries of two, they are doing an efficient, economical job of keeping all units in this many-family community snugly warm and comfortable.

The selection of American-Standard heating equipment for this development is just another example of the tremendous preference that exists among builders, owners, architects and engineers for all products bearing the famous American-Standard name.

These boilers and other top quality heating equipment by American-Standard are sold through selected wholesale distributors to heating and plumbing contractors. **American Radiator & Standard Sanitary Corporation**, P. O. Box 1226, Pittsburgh 30, Pa.

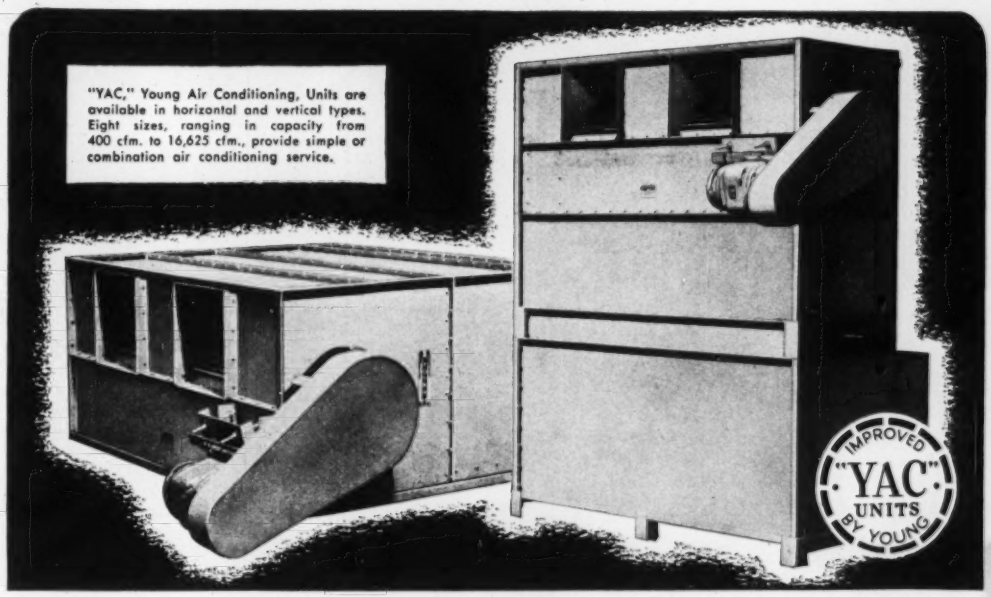
LOOK FOR THIS AMERICAN-STANDARD HEATING PIPING MARK OF MERIT



American-Standard Water Tube Boilers are made in a wide range of sizes so that, either single or in battery, they meet the heating requirements of any type of building. The diagrams above are front and sectional views of No. 36 Water Tube Boiler. In the sectional diagram, dimensions indicated are: (A)—from 29½" to 65½". (B)—32¾" to 68¾". (L)—36" to 72".

Serving home and industry

AMERICAN STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON


"YAC," Young Air Conditioning, Units are available in horizontal and vertical types. Eight sizes, ranging in capacity from 400 cfm. to 16,625 cfm., provide simple or combination air conditioning service.
IMPROVED
"YAC"
UNITS
BY YOUNG

YOUNG SECTIONAL DESIGN OFFERS NEW VERSATILITY IN AIR CONDITIONING

You've plenty of latitude in specifying or installing "YAC" Air Conditioning Units by Young. They can be furnished in either horizontal or vertical types for ceiling or floor mounting, and with discharge direction as required. Motor, drive, and service connections can be located on either side.

We believe you'll appreciate the performance as well as the installation economies of "YAC" Units. Factory-built sub-assemblies and Young's advanced heat transfer engineering account for their design simplicity, operating efficiency, and growing popularity with Architects, Engineers, and Contractors. No matter what you expect from air conditioning equipment, next time call on Young to do it—and do it economically. Mail coupon, below, for further details and new "YAC" Catalog No. 7550.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

T. M. Reg. U.S. Pat. Off.

Heating, Cooling, and Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

DEPT. 511-E, RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives in All Principal Cities

LEARN HOW "YAC" SECTIONAL DESIGN CUTS HANDLING AND INSTALLATION TIME . . . . .

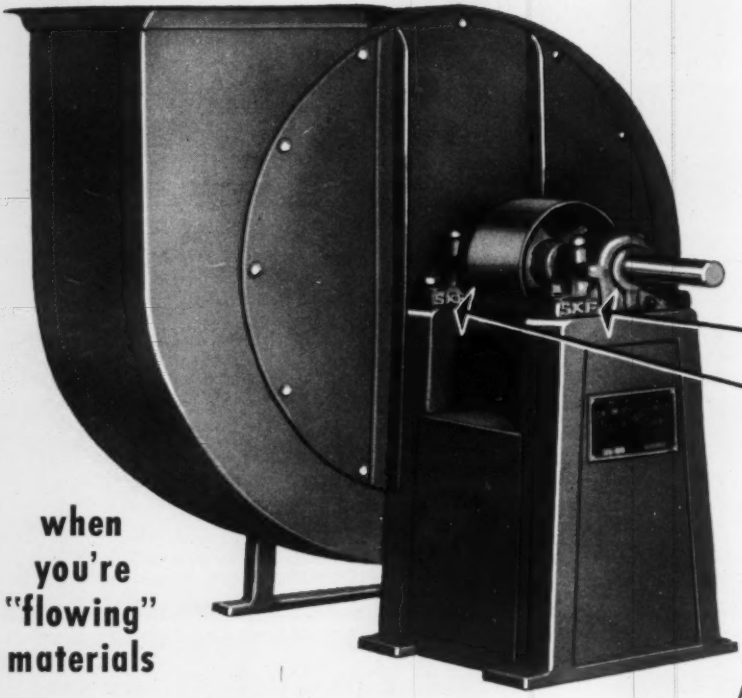
YOUNG RADIATOR COMPANY
Dept. 511-E
Racine, Wisconsin

Please send me a copy of your catalog No. 7550 giving capacities, ratings, and dimensional data on "YAC" Air Conditioning Units by Young.

Name_____

Address_____

City_____ Zone____ State_____



when you're "flowing" materials

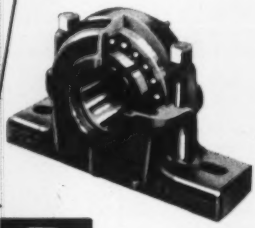
FT. WORTH FANS help keep them going

Ft. Worth Industrial Fans* are specially adapted for use in conjunction with pneumatic materials handling systems. Sturdy, economical to operate, these fans maintain the proper volume and velocity of air in conveying systems, and are equally effective as a means of removing foul air and gases.

As in so many industrial exhaust fans, friction is minimized by SKF Ball Bearing Pillow Blocks—in this case, one stabilized and one floating.

Whether your problem is one of new equipment application or bearing replacement, you can rely on SKF to help you put the right bearing in the right place.

*For complete details on Ft. Worth Industrial Fans, write Ft. Worth Steel & Machinery Co., P. O. Box 1038, Ft. Worth, Texas. 7214



8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity
craftsmanship
metallurgy
tolerance control
surface finish
product uniformity
engineering service
field service

SKF

SKF INDUSTRIES, INC., Phila. 32, Pa.
manufacturers of
SKF *and* HESS-BRIGHT *bearings*

BE SURE OF SAFE VENTING WITH QC METALBESTOS

PERMANENTLY ATTACHED BOTTOM COUPLER
VENTILATED AIR SPACE
HOLES AND SLOTS FOR COUPLING SCREWS
PERMANENTLY ATTACHED TOP COUPLER
ALUMINUM DOUBLE WALL CONSTRUCTION

Improper venting of gas appliances always brings customer complaints and sometimes results in serious financial loss to contractors. Metalbestos' unique pipe-within-a-pipe construction assures safe, efficient venting. Precision made Quick-Couplings align pipe sections automatically and form a permanently gastight connection. Even when unskilled workers install foolproof Metalbestos, you know the job is right and will give years of trouble-free operation.

LOWER INSTALLATION COST

Made of corrosion-resistant, lightweight aluminum, Metalbestos is easy to handle, simple to install. Only 3 screws are needed to quickly connect pipe sections without using mastic, cement or banding material. No special tools are required. Adjustable lengths, adjustable elbows and other versatile fittings permit rapid assembly and eliminate expensive, time-consuming cutting and fitting.

NOW AVAILABLE!

A new manual, "Venting of Gas Appliances", is now ready for distribution. Published in the interests of better venting, this valuable booklet contains the important rules for venting gas appliances and other helpful information regarding good venting practices. Yours without charge — simply fill out coupon. No obligation.

METALBESTOS DIVISION WILLIAM WALLACE COMPANY • BELMONT, CALIF

METALBESTOS DIVISION Department N
WILLIAM WALLACE CO. • Belmont, California

Please send a copy of your new manual, "Venting of Gas Appliances."

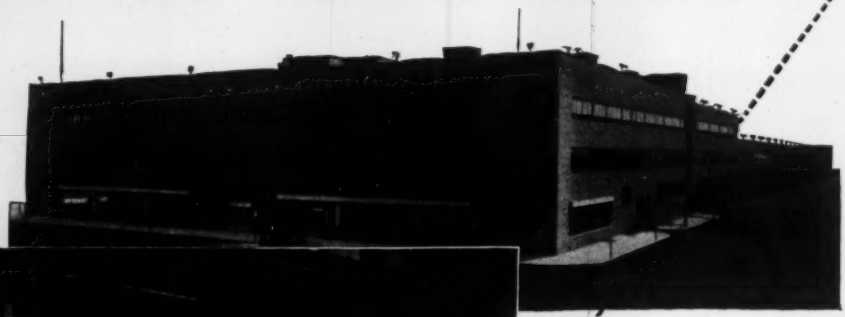
NAME _____ TITLE _____

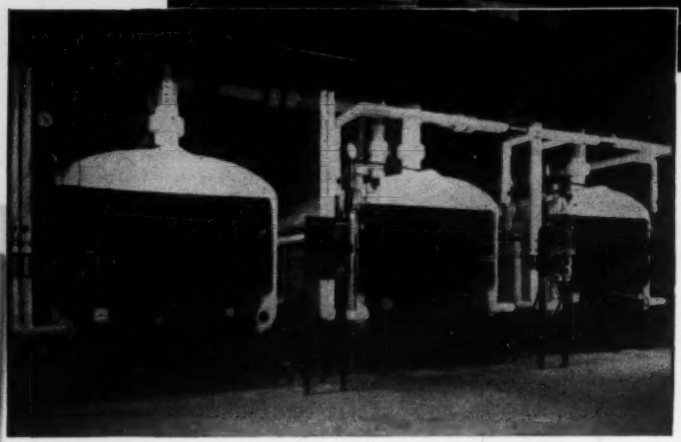
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

The WORLD'S LARGEST UNION motor truck terminal.....





.....chooses

H.B. Smith

BOILERS

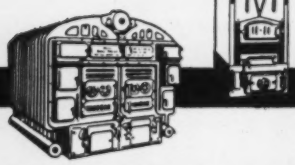
Battery of three No. 60-S-17 H. B. Smith oil-fired cast iron boilers, each with net steam rating of 12,925 sq. ft. Owner, Architects and Engineers of Terminal: The Port of New York Authority, New York. Heating Contractors: August Arace & Sons, Inc., Elizabeth, New Jersey.

To assure trouble-free heating and hot water supply, The Port of New York Authority selected H. B. Smith cast iron boilers in the new Union Motor Truck Terminal at Newark, N. J.

For the 31,000 feet of steam radiation, three No. 60-S-17 Smith oil-fired cast iron boilers do an eminently competent job, as does the No. 340-W-11 Mills boiler in the adjacent maintenance building.

In winter, four No. 608 Smith Manifold Indirect Heaters provide a total hot water capacity of 1680 GPH at 100°F. temperature rise, while in summer, one No. 34-W-11 Smith oil-fired unit with capacity of 1596 GPH is adequate.

H.B. Smith



SINCE 1853 CAST IRON BOILERS

THE H. B. SMITH CO., INC., WESTFIELD, MASS.

Most complete line in the world of cast iron boilers for heating

PENN

TO GIVE YOU SUPPORT with strong national consumer advertising

Through the years, PENN has given you heating controls which are *second to none.* In fact, it has pioneered and *led* the control field since 1934 with HEAT ANTICIPATION . . . a principle of thermostat operation which holds temperature within one degree . . . *stops* HOT-n-COLD LIVING!

Now . . . PENN is giving you more than an outstanding product. It is giving you the support of a powerful *spring and fall* consumer advertising program which will *tell your prospects how to avoid* HOT-n-COLD LIVING! And we're asking them to see their heating dealer . . . *that means you.* Remember . . . for greater customer satisfaction, greater good-will, greater profits . . . recommend and install PENN heating controls. **Penn Electric Switch Co., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.

BETTER HOMES & GARDENS
AMERICAN HOME
NEWSWEEK

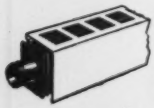
fed up with HOT-n-COLD LIVING?
enjoy 1° temperature control with
PENN
heat anticipation
Comfort with a capital "C"! That's what you'll enjoy when your heating system is controlled by the amazingly sensitive PENN heat-anticipating thermostat.
It "feels" approaching temperature changes before you do and starts the burner before the room has a chance to become uncomfortable. Result? Room temperatures are held within 1° regardless of outside weather conditions . . . that's real, healthful comfort!
This accurate control stops fuel waste caused by HOT-n-COLD heating. For even greater fuel economy of automatic day-night control, also get PENN Temp-Clock. If you want automatic heating at its best, ask your dealer for PENN heat anticipation . . . it comes no more!
Penn Electric Switch Co., Goshen, Indiana
ENGINEERED COMFORT
PENN
AUTOMATIC CONTROLS
Selected by leading manufacturers for over 30 years
FOR HEATING, REFRIGERATION, AIR CONDITIONING PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

PENN AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

VULCAN
FIN TUBE RADIATION
FOR EVERY HEATING NEED

Easy adaptability to every heating need and every type of building construction is one of the principal reasons why Vulcan is popular with heating engineers from coast to coast. Vulcan Radiation also is available in sizes to satisfy heat load requirements (see right) . . . in steel, or copper to meet particular water conditions . . . in desired lengths for easy installation on the job.



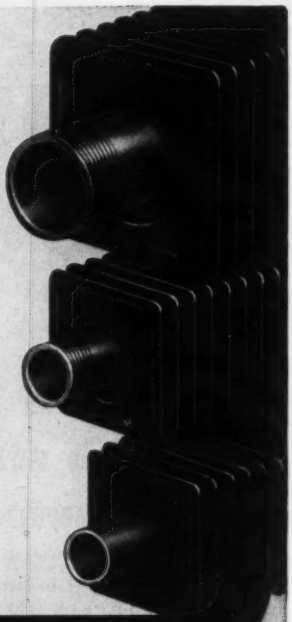
Left: Vulcan Radiation with Type F cover.

Right: Vulcan Radiation with Type S cover.

2" IPS steel
4¼" x 4¼" steel fins

1¼" IPS steel
3¼" x 3¼" steel fins
4¼" x 4¼" steel fins

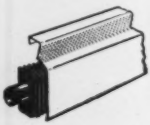
1¼" Nom. copper
Copper or aluminum fins 3¼" x 3¼", 4¼" x 4¼"



VULCAN STANDARD FOR INDUSTRIAL HEATING

VULCAN RADI-VECTOR FOR HOME HEATING

Home owners, from the typical colonial homes of Maine to the ranch type homes of California, have found Vulcan baseboard radiation, "Radi-Vector", supremely suited to their ideas of heating comfort. By the same token Vulcan is popular with both engineers and architects because its simple linear construction is so easily adaptable to this wide range of architectural design.



Left: Radi-Vector with Type L cover.

Right: Radi-Vector with Type K cover.

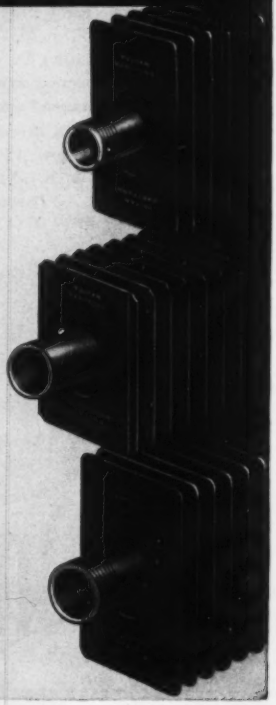
1" IPS steel
2" x 4¼" steel fins

¾" Nom. copper
2" x 4¼" aluminum or copper fins

1¼" Nom. copper
2¾" x 3¾" copper or aluminum fins

1¼" IPS steel
2¾" x 5" steel fins

1¼" Nom. copper
2¾" x 5" copper or aluminum fins



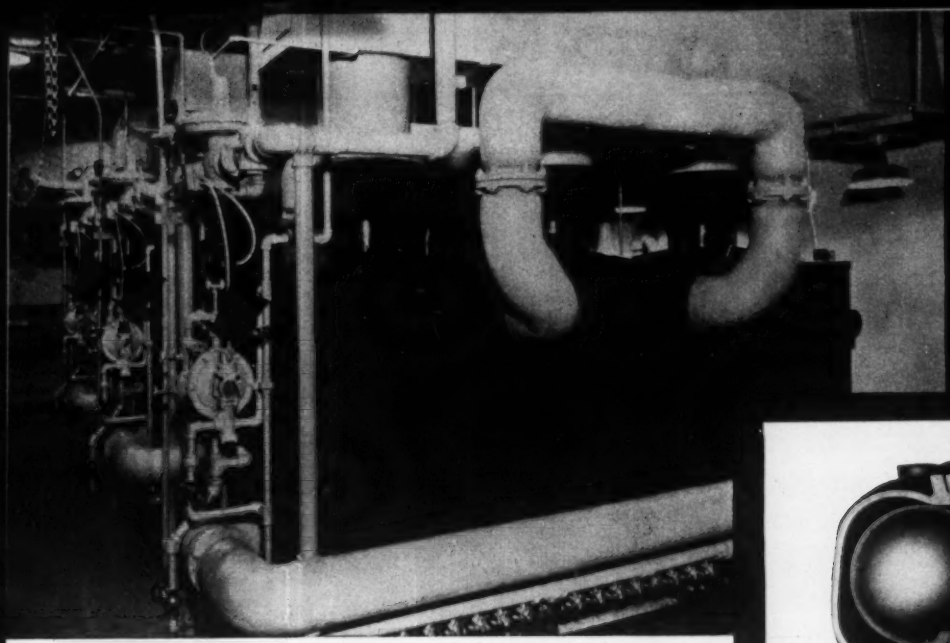
No Heating Job is Too Tough for VULCAN

Made in Canada under the trade name of Heal Radiation by the Vapor Car Heating Company at Montreal.

Availability of material subject to Government Regulations.

THE VULCAN RADIATOR COMPANY

26 FRANCIS AVE., HARTFORD 6, CONN.



. . . From big plant to home boiler

They All Need McDonnell Controls

No boiler installation is complete unless it is safeguarded from low water by the most dependable of all boiler water level controls — *McDonnell.*

Here you see a handsome battery of three Standard gas boilers in one of California's newest office buildings. Modern boilers, expertly installed, they are wisely protected by three McDonnell No. 51-2 feeder cut-off combinations.

Since good engineering accepts no unnecessary risks, you will almost invariably find McDonnell boiler water level controls a part of the modern engineered heating plants that are going in today. But this simply serves to emphasize the even greater need for McDonnell protection for boilers that will not be as carefully watched and attended as the large installations.

Whether large or small; whether hand fired, stoker fired, oil fired, or gas fired; whether low, medium, or high pressure . . . there is a McDonnell boiler water level control that will give every steam boiler maximum protection from the ever-lurking danger of low water. Typical controls are briefly described here. Ask for latest condensed catalog and price data.

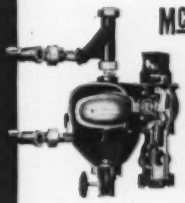
In addition to water level controls for steam boilers, McDonnell boiler protection includes Btu.-rated, A.S.M.E. standard safety relief valves for hot water heating boilers and domestic water heaters and tanks; also water feeders and low water fuel cut-offs for hot water heating boilers. All are described in the new Condensed Catalog.

McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

McDonnell No. 51-2

McDonnell No. 51-2 feeder cut-off combination. This is the control installed on the battery of Standard Gas Boilers, opposite, product of American Radiator & Standard Sanitary Corporation. No. 51-2 is for boilers of any size; maximum steam pressure, 35 lbs. Feeder supplies water to maintain minimum water level; switch stops burner if emergency low-water condition should ever occur, making the boiler water level as automatic as the firing. Available without cut-off for hand fired boilers.



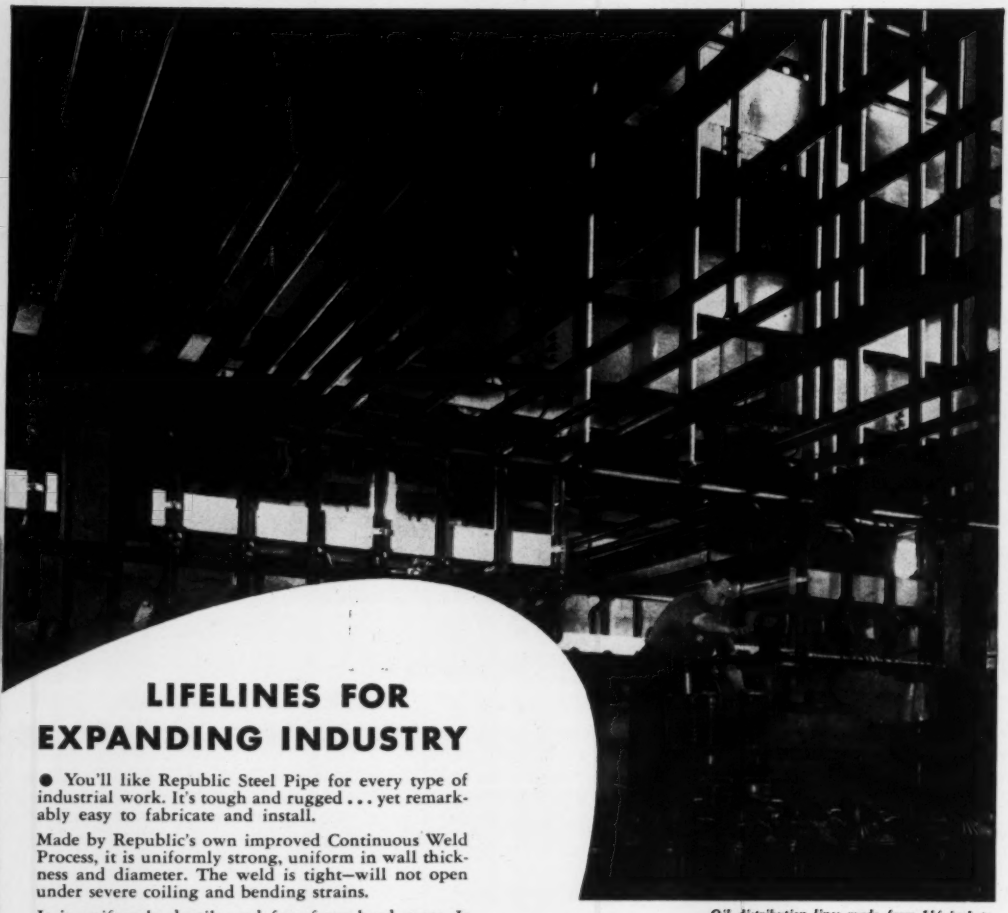
McDonnell No. 47-2

McDonnell No. 47-2 feeder cut-off combination. This control covers the largest class of heating boilers — up to 5000 sq. ft. capacity; maximum steam pressure, 25 lbs. Its operating cycle is the same as the No. 51-2. Available without switch for hand fired boilers.

McDonnell No. 150

No. 150 low water cut-off, pump control and low water alarm. This control is for higher pressure boilers of any size (up to 150 lbs.). It dependably starts and stops the electric boiler feed pumps in exact accordance with demands of boiler. Also functions as an emergency low water fuel cut-off and alarm.

McDONNELL



Oil distribution lines made from 1½-inch to 3-inch Republic Steel Pipe. Plumbing contractor is: Schweizer-Dipple Co., Cleveland, Ohio.

LIFELINES FOR EXPANDING INDUSTRY

● You'll like Republic Steel Pipe for every type of industrial work. It's tough and rugged . . . yet remarkably easy to fabricate and install.

Made by Republic's own improved Continuous Weld Process, it is uniformly strong, uniform in wall thickness and diameter. The weld is tight—will not open under severe coiling and bending strains.

It is uniformly ductile and free from hard spots. It bends freely and smoothly. It threads cleanly and accurately . . . and welds readily by all modern methods. It comes to you in easy-to-handle uniform lengths and in waste-saving extra long lengths.

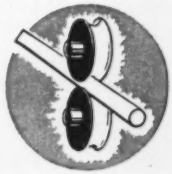
Uniformly clean and commercially scale-free—both inside and outside—it insures against clogged valves and instruments in industrial lifelines.

You'll find a Republic Pipe Jobber wherever steel pipe is used. Check with your nearby jobber now about the industrial—and radiant heating—jobs you've lined up for later in the year. He'll give you the latest information on available sizes and current delivery schedules.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Dept.: Chrysler Bldg., NewYork 17, N.Y.

REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster



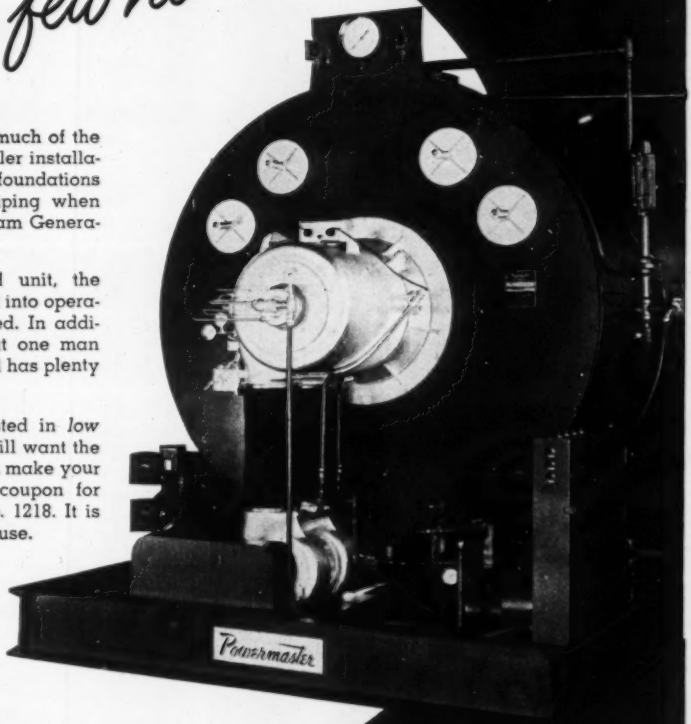
Republic
REPUBLIC STEEL
STEEL PIPE
IS FIRST CHOICE

in just a few hours

Now you can do away with much of the time and money spent for boiler installation. No costly stacks, brick foundations or assembly of extensive piping when you get the *Powermaster* Steam Generator.

A completely self-contained unit, the *Powermaster* can often be put into operation on the day it is delivered. In addition, many users tell us that one man operates the *Powermaster* and has plenty of time for his other duties.

Then too, if you are interested in *low cost* steam generation, you will want the *Powermaster* story before you make your investment. Just return the coupon for your copy of our Bulletin No. 1218. It is full of information you can use.



To meet your special needs, the *Powermaster* is made in sizes from 15 to 500 H. P. and pressures from 15 to 200 p.s.i. You can use light or heavy oil, gas or combination gas/oil firing.

SEMBOWER, INC.

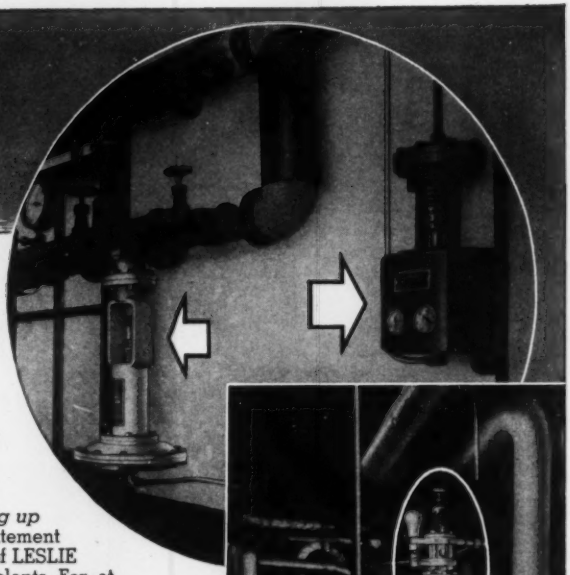
Orr & Sembower, Inc.
990 Morgantown Road, Reading, Penna.

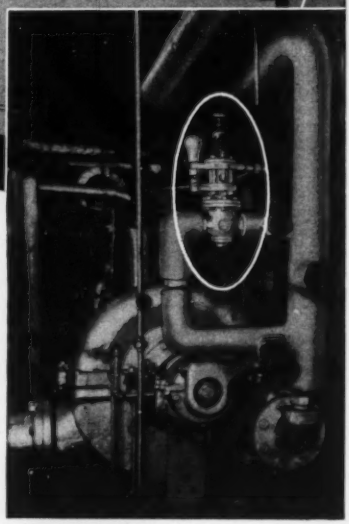
Please mail Bulletin No. 1218, showing how easy it is to install and operate *Powermaster* Steam Generators and Hot Water Boiler Units.

Name ..... Title .....
(PLEASE PRINT)
Company .....
Address .....
City ..... Zone ..... State .....

LESLIE Regulators

. . . used at American Cyanamid plants for their "very little maintenance"





Pressure Controller (upper) and Pump Governor (lower) installations at Warners Plant.

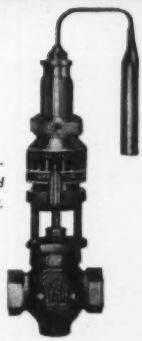
"They give good service without clogging up and with very little maintenance." That statement sums up some of the reasons for the wide use of LESLIE Regulators at American Cyanamid Company plants. For, at Willow Island, W. Va., Pearl River, N. Y., Stamford and Wallingford, Conn., Warners & Bound Brook, N. J., etc., LESLIE Diaphragm Regulating Valves, Pressure Reducing Valves, Pump Governors, Pressure Controllers and Temperature Regulators perform a great number of functions providing ideal operating conditions for the operation of other equipment.

Providing good control with freedom from maintenance, while effecting real cost savings, is a job for which LESLIE Regulators can be depended upon. Their interchangeable parts permit a standardization in keeping with modern plant operation standards.

LESLIE features which meet plant operating executives approval, include:

- ★ **Single Seated Regulators**
- ★ **Self-Contained Regulators or External Pilots without Stuffing Boxes**
- ★ **Stellited Seats**
- ★ **Hardened & Ground Stainless Steel Main Valves, Pilot or Controlling Valves and Cylinder Liners.**
- ★ **Corrosion & Heat Resistant Alloy Internal Springs**
- ★ **Full Spring Temper Diaphragms**

Whether your service be Steam, Air or Gas, LESLIE longer-lasting, accurate, Regulators will assure you of similar trouble-free operation.



LESLIE Class MCC-1 Temperature Regulator with Calibrated Dial and Liquid Filled Element.

SEND FOR—

New Pressure Temperature and Liquid Level Regulator Selection Chart, Bulletin 502.

Lowest Overall Cost per Operating Year

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.	Buffalo, N. Y.	Greensboro, N. C.	Milwaukee, Wis.	Pittsburgh, Pa.	Savannah, Ga.
Albuquerque, N. M.	Chicago, Ill.	Greenville, S.C.	Minneapolis, Minn.	Ponca City, Okla.	Seattle, Wash.
Atlanta, Ga.	Cincinnati, Ohio	Houston, Texas	Mobile, Ala.	Portland, Ore.	St. Louis, Mo.
Baltimore, Md.	Cleveland, Ohio	Kansas City, Mo.	Monroe, La.	Providence, R. I.	Syracuse, N. Y.
Beaumont, Tex.	Denver, Colo.	Kingsport, Tenn.	New Orleans, La.	Richmond, Va.	Tucson, Ariz.
Birmingham, Ala.	Des Moines, Iowa.	Los Angeles, Calif.	New York, N. Y.	Rochester, N. Y.	Wilkes-Barre, Pa.
Boston, Mass.	Detroit, Mich.	Louisville, Ky.	Orlando, Fla.	Rutherford, N. J.	Wilmington, Calif.
Bridgeport, Conn.	Duluth, Minn.	Memphis, Tenn.	Philadelphia, Pa.	San Francisco, Calif.	Youngstown, Ohio

Montreal, Que., Can. Toronto, Ont., Can. Vancouver, B.C., Can. Bruxelles-Forest, Belgium

ESTABLISHED 1900

LESLIE CO.

237 Grant Avenue, Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES

CUTS DAMAGE AND REPLACEMENT COSTS

NEW HEAVY-DUTY INDUSTRIAL GRILLE

CUSTOMED FOR FACTORY USE AND ABUSE

This grille especially designed for Atomic Energy Commission.

Contractors—
Maxon Construction Company

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L. Rossetti Associated, Eng. & Arch.
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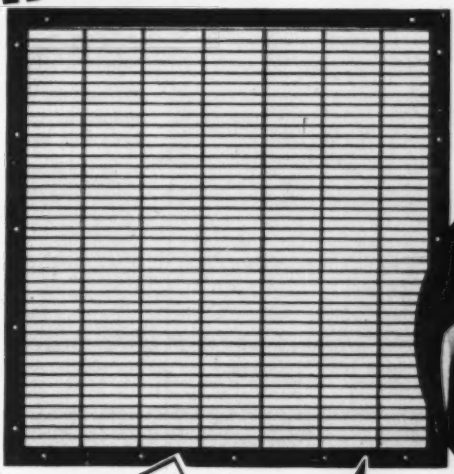
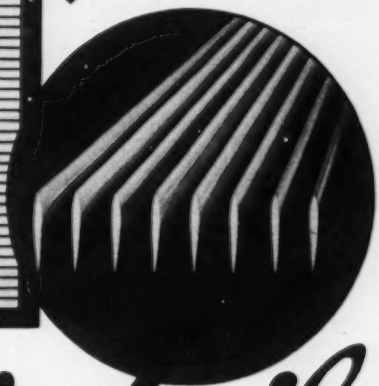
Detroit, Michigan

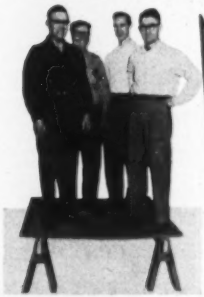
- 14 GAUGE STEEL BLADES
- VERTICAL SUPPORT BARS PLACED ON 6" CENTERS (14 GAUGE STEEL)
- STANDARD GRADE PRIMER COAT FINISH
- 16 GAUGE STEEL, EXTRA WIDE BORDER FOR EASY MOUNTING



At left—Grille face of LOWER WALL, INDUSTRIAL GRILLE. Note close spacing of extra-strength blades (3/8" centers).

Below—Close-up view of volume control section. Note famous solid section AIRFOIL LOUVERS. Each blade is individually adjustable. CONCEALED LOUVER SUPPORT eliminates mullions and butted construction.





At left— photo shows the 48" x 48" AIRFOIL INDUSTRIAL GRILLE supporting the combined weight of 4 Titus factory workers.

AirFoil
AIR CONDITIONING OUTLETS

Write for new, FREE complete catalog of Titus AIRFOIL air conditioning outlets — the most efficient grilles ever designed.

Free

More highly efficient . . . longer lasting . . . brand new . . . that's the AIRFOIL-DESIGNED, AIRFOIL-BUILT INDUSTRIAL GRILLE. Clean cut—compact—it is made in two sections . . . Grille Face and Volume Controller.

Rugged—braced for super-strength. The INDUSTRIAL GRILLE will stand up for years and years against the punishing knocks—jars—shocks—scratches and abuse that floor level grilles must take.

Volume Controller section features the famous solid section, streamlined AIRFOIL LOUVERS. Noise and turbulence are cut to a minimum. At the same time, perfect draft-free, air distribution is assured.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ Rush information on Industrial Grilles.
- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

NAME_____

ADDRESS_____

CITY_____ STATE_____

UNSURPASSED IN EFFICIENCY • ECONOMY • VERSATILITY

Staynew DRY PANEL FILTERS

Feature Pre-formed, Wire-clad Inserts

Cell removed from frame by sturdy offset handles after releasing locking cams.

Removing pre-formed Insert is simple. Snap catches are released, cover lifted off, Insert lifted out.

Dis-assembled cell showing removable cover, Insert and box containing permanent fin support.

Insert easily slipped on permanent fin support by means of special Staynew Loading Knife.

. . . *pre-formed* so that Inserts can be slipped on or off the permanent fins in seconds! . . . *wire-clad* for complete protection of medium and maximum fire resistance! . . . *Class I Underwriters' Approval* in bonded glass!

FIN CONSTRUCTION provides the greatest possible filtering area in available space. Resistance in relation to dust load is less than in panel filters built on any other principle.

OPERATING ECONOMY is amazing. The most fragile medium can be cleaned repeatedly either by vacuum or fluid (dry-cleaning). Insert replacement cost is very low.

STAYNEW DRY PANEL FILTERS are *versatile* . . . utilizing any medium in sheet form that can be crimped. Stock media include wool felt, rayon-cotton-wool felt, bonded glass, and Feltex. The latter is a surprisingly low cost, highly efficient medium.

INSTALLATION can be in flat or V-banks, frames riveted but individual cells removable in a matter of seconds. All standard sizes are available in 2″, 4″ and 8″ depths.

FOR EVERY DRY PANEL NEED there is a Staynew model and medium for maximum efficiency at minimum cost.

WRITE FOR BULLETIN DPF

Representatives in Principal Cities

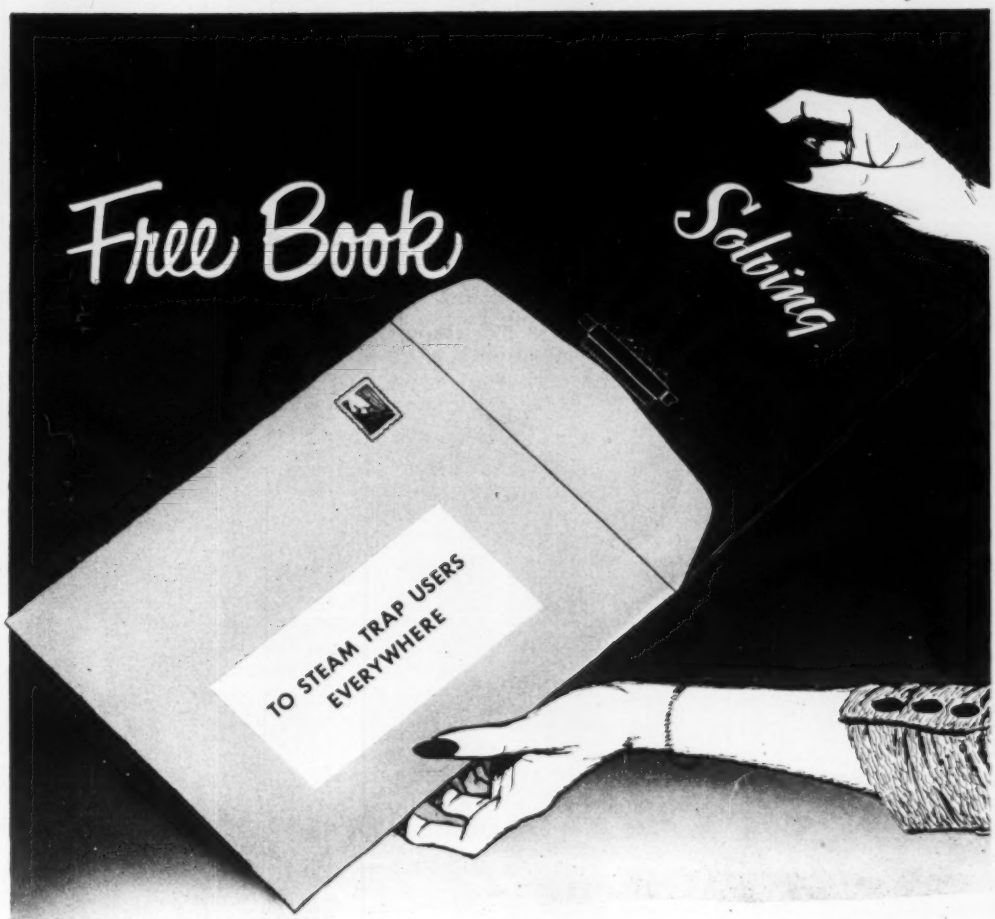
DOLLINGER CORPORATION

9 CENTRE PK., ROCHESTER 3, N. Y.

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

Free Book

Solving



We want to send you this 36-page book because it will help you save money, as it has so many other steam trap users. This manual tells how to service steam traps without disturbing a single pipe fitting. It also gives timely information on how to *save 7 fittings* on every new trap installation.

In addition, you'll learn to select traps that eliminate fuel waste caused by inefficient trapping. Gives condensation rates for different steam-using equipment . . . explains trap capacity factors and how to determine lift of a trap. Written in easy-to-read, amply illustrated style. Mail coupon today.

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio

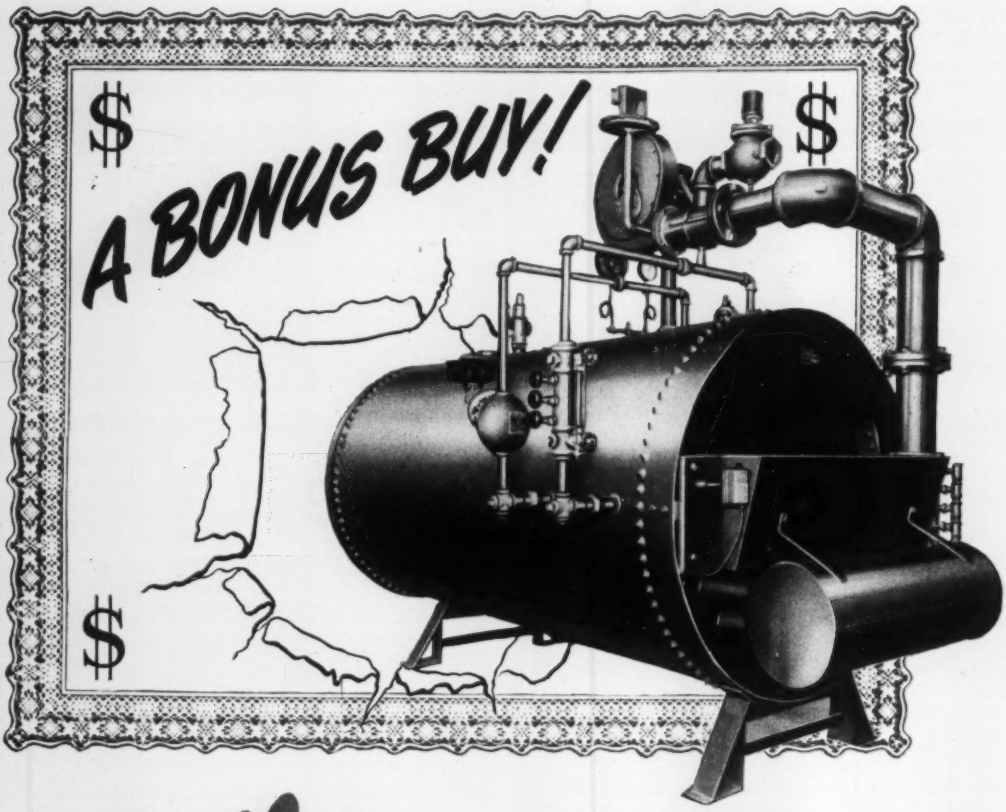
Gentlemen: Please send me a free copy of the book, "Solving Steam Trap Problems."

Name _____

Address _____

City _____ *State* _____

In Canada: Bawden Machine Co., Toronto.



Sellers IMMERSION STEAM BOILER

You get a big bonus in economy, efficiency and performance when you buy a Sellers. The super efficient boiler has a *higher heat transfer* rating. Since the heat passes from completely submerged firing tubes to the water at a faster clip, more heat gets into the water and *less* goes up the stack.

It's as simple as that. But this efficiency is available only through Sellers immersion firing principle which so correlates diameter and length of firing tubes to BTU input that the hot expanding gases literally scour tubes free of the insulating film of dead gases, leaving nothing but metal between the heat and the water. These are proven facts based on laboratory tests and performance records of thousands of installations.

And that's only part of the story. Here are some other bonus values inherent in Sellers design:

No water line corrosion on the completely submerged firing tubes.

Scale is effectively combatted. Alternate expansion and contraction of firing tubes under intermittent firing crack it off.

No separate enclosed combustion chamber. No explosion hazard. No brick linings to replace. No carbon traps.

Faster steaming, dry steam and no surging.

Available in twelve sizes to meet all standard requirements. All are built to A.S.M.E. Power Codes. Bulletin No. 1206-C will give you full details. If you're considering a boiler for heating or process steam it will pay to write for it today.

SELLERS ENGINEERING COMPANY
4876 No. Clark Street, Chicago 40, Illinois

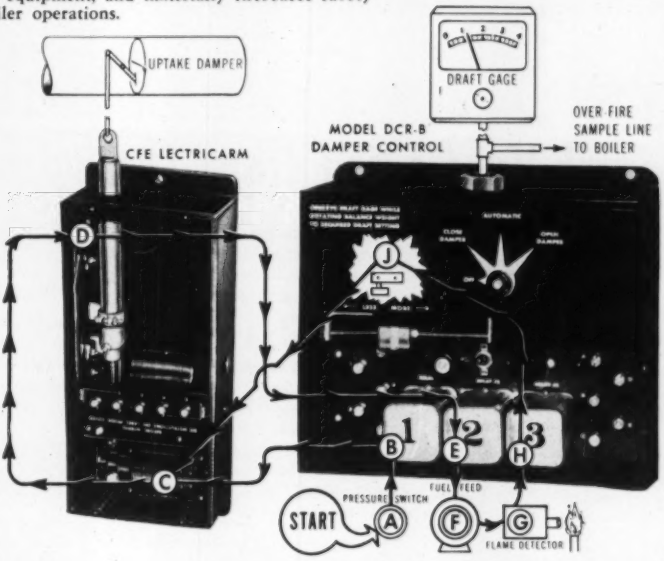
Blast Heaters. Immersion Automatic Water Heaters. Vertical Steam Boilers. Air Heaters. Combustion Units. Industrial Gas Burners. Immersion Tank Heaters. Gas Combustion Equipment

YOU CAN GET

Automatic Sequence Control at Low Cost with

CLEVELAND DAMPER CONTROL

The initial cost of this equipment is so low that most installations pay for themselves, in fuel savings alone, in less than a year. One compact unit contains all the elements for safe, automatic electrical control from over-fire draft, providing proper draft and proper timing to assure perfect combustion at all times. Applicable to oil, gas or stoker-fired boilers. Designed for use with C.F.E. indicating gages (draft, air pressure and flue temperature) and "Lectricarm" drive unit. In addition to fuel savings, CLEVELAND DAMPER CONTROL reduces smoke, soot and fly ash, prolongs life of boiler equipment, and materially increases safety of boiler operations.



HERE'S HOW IT WORKS: Steam pressure calls for heat, closing pressure switch (A). Signal goes to No. 1 relay (B), which energizes "Lectricarm" (drive unit) motor (C) to open uptake damper. When damper is open, with full draft established, drawbar actuates limit switch (D), signaling No. 2 relay (E), which then energizes fuel feed mechanism (F) to start firing. On oil or gas burners, a flame detector (G) signals No. 3 relay (H) when safe flame is established. No. 3 relay (H) transfers draft control to diaphragm operated switches (J), to establish automatic draft modulation by controlling reversible "Lectricarm" motor (C) linked to uptake damper, maintaining the predetermined most efficient setting. When pressure switch (A) is satisfied on oil or gas-fired boilers, No. 3 relay signals "Lectricarm" motor (C) to close damper until more heat is required. On stoker installations modulated draft continues until heat is again called for.

For further information, request Bulletin DCR-B or write for name of nearest agent

TYPICAL INSTALLATIONS

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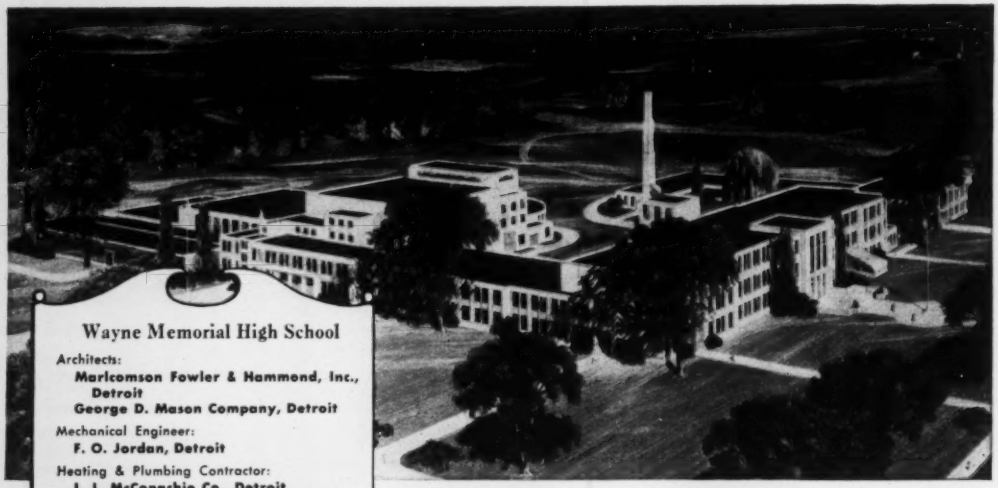
COMBUSTION INSTRUMENTS & CONTROLS — CLEVELAND FUEL EQUIPMENT CO. — FOR EFFICIENCY AND ECONOMY

CLEVELAND FUEL EQUIPMENT CO.

Complete Line of Combustion Instruments and Controls

7316 ASSOCIATE AVENUE • CLEVELAND 9, OHIO



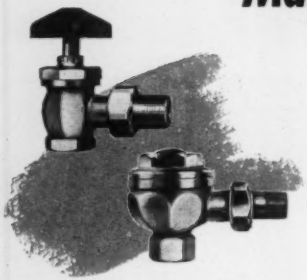
Wayne Memorial High School

Architects:
Marlcomson Fowler & Hammond, Inc., Detroit
George D. Mason Company, Detroit

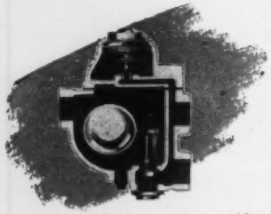
Mechanical Engineer:
F. O. Jordan, Detroit

Heating & Plumbing Contractor:
L. L. McConachie Co., Detroit

Marsh Valves and Traps Throughout



Marsh Packless Valves and Radiator Traps were chosen throughout for the Wayne Memorial High School. The most permanent packless valve construction is the Marsh metal-to-metal seal and the best team-mate for this better valve is the Marsh radiator trap.



Marsh float and thermostatic traps like this were used in the Wayne High School.

Pride of its community is this modern 3½ million dollar high school at Wayne, Michigan, near Detroit. It is a worthy addition to the growing list of model school buildings that are rising to the call of the tremendously increased number of young folks who are going in for more and more education.

Such buildings are planned and erected to become a lasting part of community activities; so it is significant that a large number of Marsh valves and traps were used in the well-engineered system which heats the laboratories, library, cafeteria, gymnasium, offices and classrooms.

But high tribute though it is, the selection of Marsh equipment here is simply one more example of the preference accorded Marsh heating specialties by foremost heating engineers and contractors in every section of America.

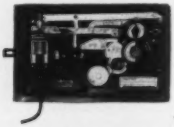
For your next job consider the equipment that is first choice of the most critical heating men. Write for the Marsh heating specialties catalog, 76-H, covering Marsh valves, traps, venting devices and the dollar-saving Marsh Tri-Trol regulator.

MARSH HEATING EQUIPMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

Dept. T, Skokie, Ill.

BIG FUEL SAVING WHEN HEAT REGULATION IS IN STEP WITH THE WEATHER:—



Marsh Tri-Trol is the simple, low-cost, easily installed heat regulator for multiple occupancy buildings from smallest to largest. Ask for bulletin showing how it gives ideal heating comfort at lowest cost by controlling heating in accordance with outside temperature.

MARSH *Heating Specialties* **SINCE 1865**

R·P&C VALVES

NO. **1050**
Stainless
Steel
Bar Stock
Valve

R-P&C Bar Stock Valves are an achievement of the valve makers' craft. They are precision turned . . . from carefully tested metals . . . and suitable for a wide range of pressures and temperatures . . . for meter, gauge, test, and general purposes.

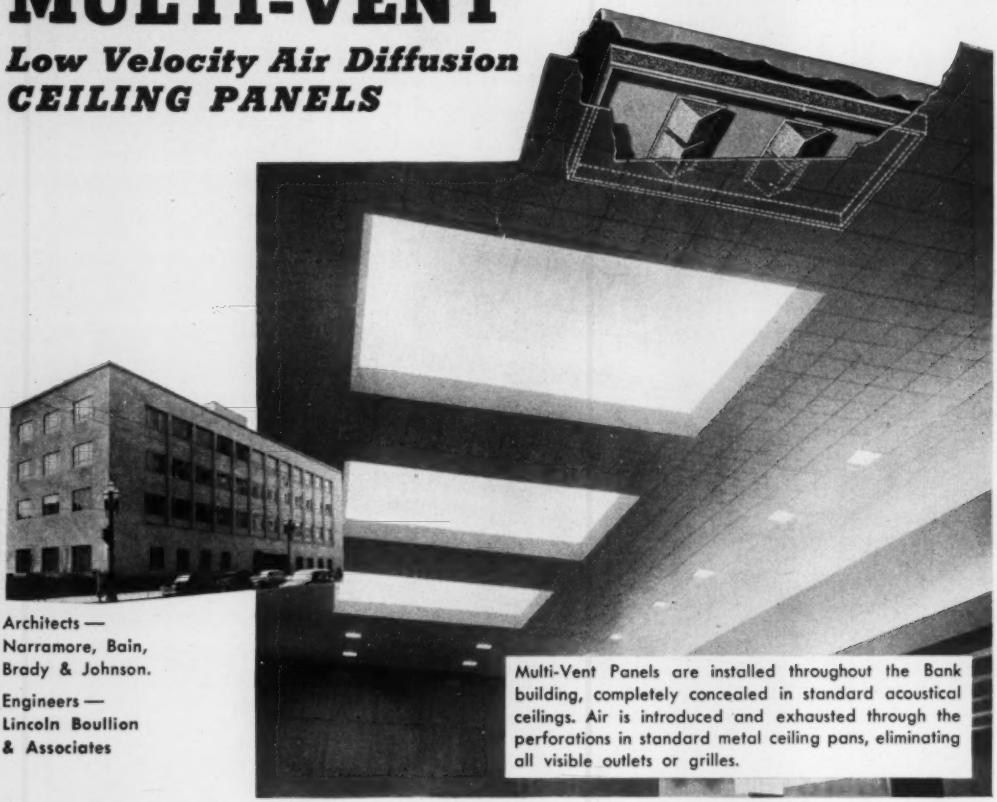
Rugged construction of R-P&C Bar Stock Valves means long, low-cost, trouble-free service. No better bar stock valves are made. See your R-P&C distributor today or write the nearest R-P&C district office for information.

"Intentionally Better"
READING-PRATT & CADY VALVES

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

MULTI-VENT

Low Velocity Air Diffusion
CEILING PANELS



Architects —
Narramore, Bain,
Brady & Johnson.

Engineers —
Lincoln Boullion
& Associates

Multi-Vent Panels are installed throughout the Bank building, completely concealed in standard acoustical ceilings. Air is introduced and exhausted through the perforations in standard metal ceiling pans, eliminating all visible outlets or grilles.

For *COMPLAINT-FREE* Heating and Ventilating

IN THE SAN FRANCISCO FEDERAL RESERVE BANK, SEATTLE BRANCH

Top-flight engineers and architects are now specifying Multi-Vent for air distribution in virtually every type of commercial and industrial building, new or old, *where true comfort,* or where perfect uniformity and accurate control of air movement, temperature, and humidity is demanded by their clients.

For unlike any other diffuser on the market today, Multi-Vent panels do *not* depend on BLOW or THROW, (high velocity injection) for distribution. In fact Multi-Vent provides perfect over-all air distribution entirely by pressure displacement, completely free from BLOW.

This pressure displacement principle, exclusive with Multi-Vent, does away with the main sources of draft hazards . . . thereby eliminating all of the most serious installation, balancing, and adjustment problems, inherent in the velocity injection principle, upon which all air diffusers *except* Multi-Vent depend.

Multi-Vent is by far and away the best, not only in performance, but in efficiency, appearance, and economy of maintenance as well.

See Sweet's Arch. & Eng. Files or write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

THE PYLE-NATIONAL COMPANY
1373 NORTH KOSTNER AVENUE, CHICAGO 51, ILL.

MULTI-VENT DIVISION

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Make piping permanent and leakproof

Write Dept. A-5 for free booklet listing properties of pipe and welding fitting and flange materials.

PIPING PERMANENCE is always important but now, more than ever, any installation of piping should be leakproof, maintenance-free and have extra long life. A piping system, big or small, is only as strong as its weakest component. That's why welding fittings, for example, should be specified with care.

TUBE-TURN Welding Tees are drawn from seamless tubing to a barrel shape—the shape every tee wants to assume under pressure. This feature, together with the generous crotch radius and thickness, explains why TUBE-TURN Welding Tees withstand more pressure without yielding. Bursting pressures obtained in tests of representative fittings have averaged more than 25% higher than required by standard codes. Here's extra quality at no extra cost.

Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

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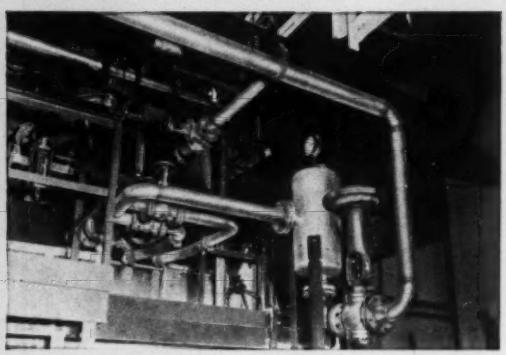
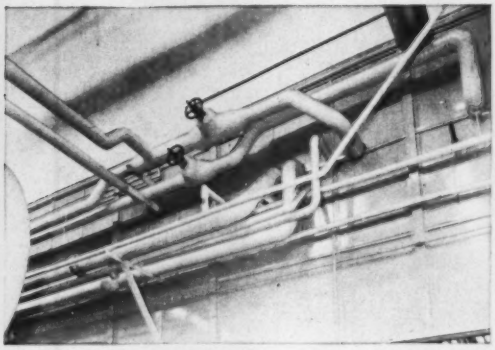
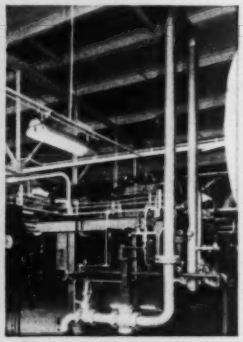
Penicillin processor welds stainless steel piping ½" and up



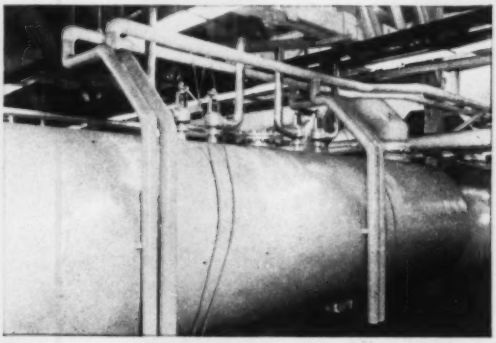
Advanced facilities in plants and laboratories help Eli Lilly and Co., Indianapolis, turn out a high volume of pharmaceuticals, biologicals, and antibiotics. This new filtration unit in the penicillin processing system uses 3" and 4" Type 316 stainless steel—chosen to resist corrosive action. Welded system with TUBE-TURN Welding Fittings and Flanges was chosen to provide maximum strength and eliminate leakage.



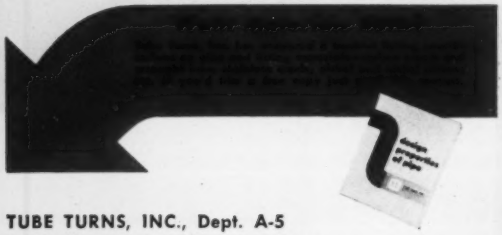
Neat appearance of insulated lines demonstrates simplicity of welded piping. Insulation was applied quickly over pipe and TUBE-TURN Welding Fittings, with no awkward joints to work around. Maintenance men know that insulation will last, with no leakage to cause deterioration. Cleanliness and neatness are prime requirements in Eli Lilly plants.



Up in the air goes a loop welded with 6" pipe, joined with TUBE-TURN Welding Fittings and Flanges. Structural strength here is a must. In this fermentation tank where life-saving penicillin is made, tiny lines of ½", as well as larger sizes, are welded. Comparable modern facilities are provided for making streptomycin and other products.



Lines to process vessel fit neatly into a small space when TUBE-TURN Welding Elbows make the turns. Eli Lilly engineers specified process piping for optimum flow conditions, compactness, and elimination of leakage.



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Lower depreciation	Satisfied users reorder
Sustained efficiency	Prestige gets new accounts

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The surest road to satisfaction with air handling apparatus is to avail yourself of Bayley's Engineering Know-how. Here are a few of the advantages to you:

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Static and Dynamic Balance

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You'll find plenty of opportunities to benefit through purchasing Bayley equipment, because the lines include:

- Centrifugal fans of all types
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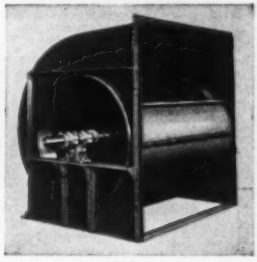
Get the best selection for the specified duty by choosing Bayley apparatus. Standard and special designs in full size ranges. No need to rely on makeshifts, or to compromise exacting specifications.

Plexiform Double-Width Ventilating Fan



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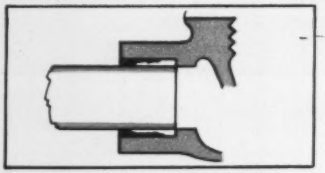
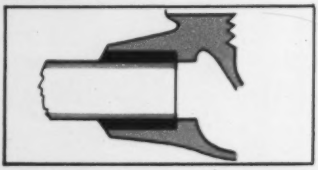
WITH O-B SOLDER TYPE VALVES



The pipe ends of some valves are thick and heavy and this excess metal makes them slow to heat, resulting in uneven heat distribution and an uneven flow of solder (note diagram) in the space between the tubing and the pipe end. The soldered joint may hold temporarily but undue strains are apt to cause it to leak.



Good copper-to-copper connections result from capillary attraction, drawing molten solder into the space between the valve pipe end and the inserted tubing. This action is aided by the tapered design of all O-B valve pipe ends which heat up quickly and evenly, allowing the solder to completely fill the joint space and produce a sound, leaktight joint.

Better copper-to-copper connections result when you use O-B solder-type valves.

By careful streamlining, O-B has eliminated heat-wasting excess metal without reducing the over-all strength of the soldered joint. The tapered pipe end heats up quicker and allows a more even distribution of heat to the inserted tubing. The result is a smooth even flow of solder which completely fills the joint space and produces a sound, leaktight soldered connection.

Strength of this soldered joint is not lessened by the streamlining of the pipe ends. By taking advantage of the inserted tubing for reinforcement, the resulting connection is more than equal to the strength of the tubing.

A complete line of O-B low pressure globes and gates with solder-type ends are available from your local Ohio Brass distributor. He will be glad to help you with any of your valve problems.

OHIO BRASS COMPANY, MANSFIELD, OHIO

4065 V

Ohio Brass VALVES

FOR DOMESTIC AND INDUSTRIAL USE

The Importance of the Revolving Discharge Outlet in the Heating of Industrial Buildings

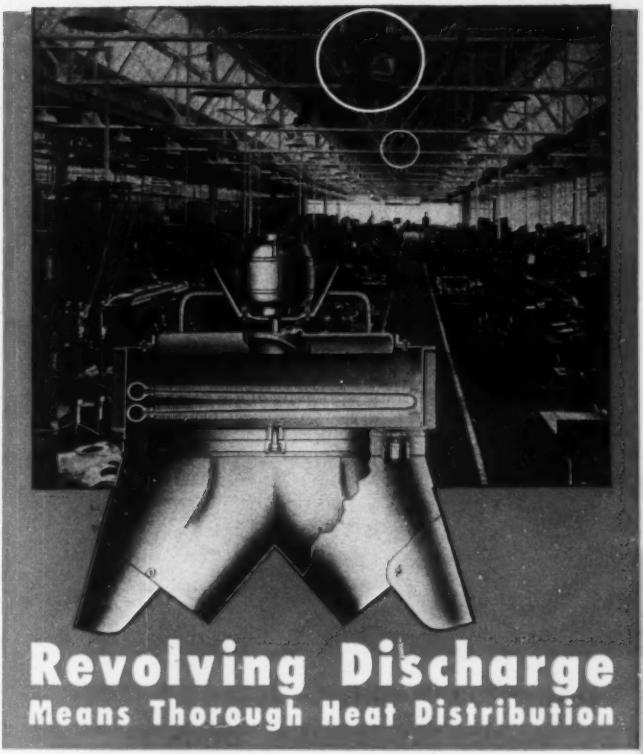
by D. Gilbert

The almost universal use of unit heaters for industrial plant heating indicates a conviction on the part of plant engineers, managers, consulting engineers and architects that this is the most satisfactory way of heating buildings and work rooms. Industry has come a long way, indeed, from the days not too long ago, when pipe coils, suspended from side walls or under windows, were the common means of heating a plant.

But, as pointed out in the article on Unit Heaters in a leading authoritative publication:

"In order to direct the air to points desired, and to diffuse the air to avoid drafts, unit heaters are commonly equipped with directional outlets, adjustable louvers, or fixed types of diffusers. . . . As hot blasts of air in the working zone are usually objectionable, heaters mounted on the floor should have their discharge outlets above the head line, and suspended heaters should be placed in such manner and turned in such direction that the heated air stream will not be objectionable in the working zone."

This is sound advice, but even with such stratagems, it is seldom possible to obtain satisfactory results. The basic difficulty lies in the use of *stationary* discharge outlets. Only one type of unit heater is able to avoid the objectionable "hot blasts" so distressing to workers in fixed positions, as on assembly lines or at machine tools. That is the heater suspended from roof or ceiling in which the downward discharge of heated air is distributed by slowly *revolving* discharge outlets. There are no fixed blasts, no chilly corners untouched by the air streams; just a gentle, thorough movement of the heated air at the working level, over obstacles, around obstructions, moving under tables, benches, truck bodies, airplane wings, even into repair pits. The result is an evenly warmed blanket of air at the working level, a gently moving, invigorating atmosphere that is pleasantly stimulating to the worker and better for his health.



Revolving Discharge Means Thorough Heat Distribution

There are three types of Wing Revolving Discharge outlets, two of which are shown here. No. 8 for high ceilings is shown in the cross-section. No. 4 for medium heights in the factory scene.

As contrasted with the stationary unit heater, which projects air in one or more fixed directions, the Wing revolving discharge outlets move slowly through a complete circle discharging heated air in constantly changing directions — reaching every inch of plant area with fresh, invigorating warmth. Hot blasts and chilly areas are eliminated, assuring maximum comfort for employees and more production for the plant owner. Write today for Bulletin HR-5 describing in detail how Wing Revolving Heaters can put an end to your plant heating problems.

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N. J.
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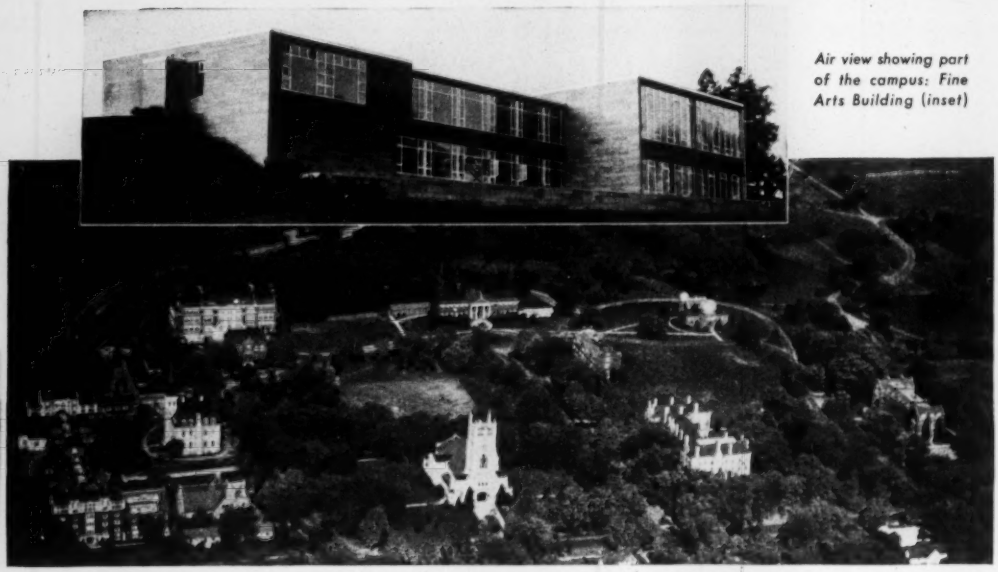
WING

Wing

Revolving UNIT HEATERS

ILLINOIS *Heating Systems*

in CARLETON COLLEGE, Northfield, Minnesota



Air view showing part of the campus: Fine Arts Building (inset)

FINE ARTS BUILDING, CARLETON COLLEGE

MAGNEY, TUSLER & SETTER, *Architects and Engineers*

GRASTVEDT PLUMBING & HEATING COMPANY, *Heating Contractors*

This famous and typically American college, founded in 1866, is located forty miles South of the Twin Cities. The buildings throughout the campus are supplied with steam from a central power plant (at extreme left). Several of the buildings, such as Gridley Hall, Freshman Girls' Dormitory, and others, are equipped with ILLINOIS Zone Control Valves and low pressure steam specialties.

The new Fine Arts Building, modern in design and up-to-the-minute in mechanical equipment, is the latest unit to be added to this notable group. ILLINOIS valves and traps are also used in this building.

Illinois Heating Systems found in America's finest buildings assure the utmost in fuel economy, heating comfort and convenience of operation.

Minnesota Representative

THE MECHANICAL SERVICE COMPANY, 809 PENCE BUILDING, MINNEAPOLIS 3.

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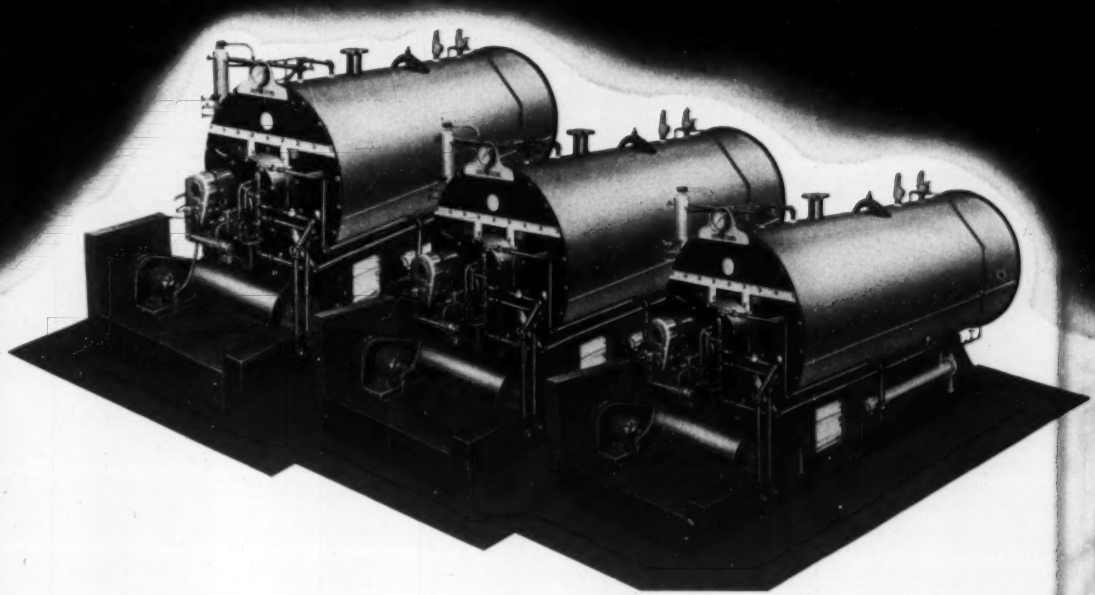

Battery installations of Superior Steam Generators provide extreme flexibility to meet the most widely fluctuating steam demands. A hospital installation illustrates the point.

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By employing different combinations of the three, (7 in all) allowing each unit in turn to share the load; all enjoy longer life at maximum efficiency . . . and by using only the number dictated by the steam demand, maximum economy at every stage of steam demand is assured.

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THE NEW

BOOK No. 2

Nos. 26—50

practical piping layouts

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The second series of twenty-five basic Piping Layouts (published by Jenkins Bros. in leading industrial, professional, and engineering publications) is now available in booklet form.

If you are among the hundreds of valve-users who received a copy of the first book, or if you saved any of the fifty Jenkins Piping Layouts as they appeared, then you know how helpful this information can be in planning any valve installations.

This new book brings you not only 25 practical piping layouts, arranged in convenient form for quick reference. It also includes a section on the fundamentals of valve design and application to help you select the type of valves best suited for the service.

Use it as a guide to proper valve selection and placement for longest service life and lowest operating costs. Use it also for an introduction to the wide range of Jenkins Valves for every industrial engineering and plumbing-heating service. You can obtain a copy by requesting it on your business letterhead. Address:

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Tells "Which valve where, and why"—with information in chart form for quick reference. A compact manual that will be prized by everyone, beginner and veteran alike, who plans piping.

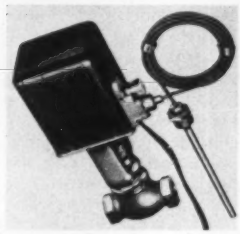
EQUIPMENT DEVELOPMENTS...

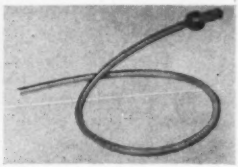
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1951 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in your Directory Section; double asterisk, equipment and manufacturer not listed.

Temperature Regulator

HPAC 1—New self-contained temperature controllers, which need no linkage or adjustment before or after installation, are offered by Barber-Colman Co., Rockford, Ill.

Available in two styles, and in sizes from ½ in. through 4 in., the unit features an adjusting dial calibrated for degrees Fahrenheit. It operates by two-wire connection to a 115 or 230 volt a-c circuit.





Above: Flame Failure Safeguard

Left: Temperature Regulator

Flame Failure Safeguard

HPAC 2—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass., has developed a new series of "Fireye" flame failure safeguards and programming controls. According to the manufacturer, the series FP controls offer to industry for the first time a photoelectric flame failure safeguard which can "see" all types of flames — gas, oil, pulverized coal — and protect against the hazard of explosion.

The scanner of the systems is the "Firetron" tube, a new photo-conductive cell which is designed to give instantaneous and positive response to flame failure. The scanner is installed in a short length of ½ in. standard pipe, located where its sensitive cell can scan the flame area. This scanner replaces the company's flame rod and photoelectric scanner, reducing installation servicing problems.

The scanner, coupled with the new programming control, monitors the complete firing cycle from pre-ignition purge through post-fire purge. It checks the pilot and the establishment of the main flame; then provides protection throughout the complete firing period.

All components are mounted in a dust-tight housing, and timing is accomplished through a high torque synchronous motor. Plug-in construction of the complete chassis simplifies replacement and provides accessibility for examination.

New "Absolute" Air Filter

HPAC 3**—A new jointly owned company to manufacture a unique air filter, first used by the Atomic Energy Commission to keep radioactive particles out of the atmosphere, has been formed by Arthur D. Little, Inc., Cambridge, Mass., and Carrier Corp., Syracuse, N. Y. Headquarters of the new company, known as Cambridge Corp., is in Syracuse and initial production of the new filter is now under way.

Developed by the Massachusetts firm, filter units can be built to handle 1000 cfm at pressures within the capacities of central station air conditioning systems. In tests conducted in connection with atomic energy developments, it is reported that as many as 20,000 particles of various kinds might be present in a single cubic inch of ordinary atmosphere. Conventional air cleaning devices are said to reduce this number to between 1000 and 3000. The new filter, however, is said to pass on the average only a single particle. The filtering medium is a special soft and feltlike paper containing sub-microscopic asbestos fibers which direct the air through tortuous paths so that essentially all of the particles become entangled in the fibers. Large sheets of this paper are folded in accordion fashion and fitted into a frame.

The new filter is said to be particularly useful wherever air must be completely dust free or sterile, as in the manufacture and assembly of precision devices, in hospitals, biological laboratories and pharmaceutical plants.

FOR YOUR CONVENIENCE [5-51]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23							
101	102	103	104	105	106	107	108	109	110
111	112	113	114		116	117	118	119	120
121	122	123	124	125	126	127	128	129	

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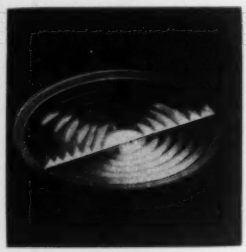
Air Diffusers

HPAC 4—A new line of high pressure, aspirating air diffusers (Type HPW-1) is available from Anemostat Corp. of America, 10 E. 39th St., New York City.

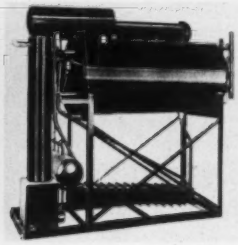
Units are available in three sizes. The No. 15 is rated at 80 to 170 cfm primary air capacity at 0.5 to 2.35 in. of water static pressure. No. 17½ is rated at 105 to 222 cfm at 0.68 to 3.1 in., and No. 20 is rated at 145 to 312 cfm at 0.7 to 3.2 in. Units are designed to induce room air, mix it with primary air in approximately equal proportions, and discharge the mixture through an aspirating air diffuser. According to the manufacturer, for each 100 cfm of primary air more than 200 cfm of total air is discharged by the unit.

Diffusers are recommended for air distribution systems which carry air at velocities up to 5000 fpm and static pressures up to 6 in. of water. The manufacturer also states that high temperature differentials (up to 30 F) can be handled and the temperature difference between primary air and the ambient temperature of room air is limited only by the dew point, to avoid condensation.

The air volume can be manually or automatically controlled. The control valve and sound trap are said to be capable of attenuating duct noises from 90 decibels on the high pressure side to 40 decibels on the low pressure side at a background sound level of 30 decibels.



Air Diffuser



Water Chiller

Absorption Type Water Chiller

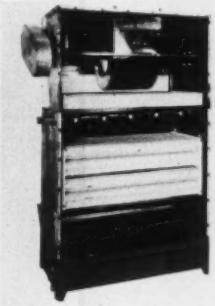
HPAC 5*—Servel, Inc., Evansville, Ind., is now producing a 20 ton absorption-type water chiller for use with air conditioning units and in manufacturing processes. It may be employed with a variety of water circulating pumps, heat exchange surfaces, blowers, filters, steam controls, cooling towers and other auxiliary equipment not furnished with the unit.

When operating at rated capacity and when furnishing 45 deg water (with condensing water at 85 F) the unit uses 360 lb per hr of steam. The capacity may be increased by varying steam supply and condensing water temperature. Because there are no moving parts, the unit is said to require no vibration dampening or noise insulation. It is at present available for defense orders only.

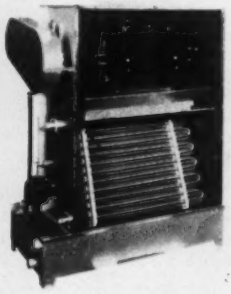
Evaporative Condensers, Cooling Towers

HPAC 6—Bush Mfg. Co., West Hartford 10, Conn., has redesigned its line of evaporative condensers and cooling towers with resultant savings in floor space requirements and cubic volume.

The new condensers retain the same bare tube surface as formerly, and the cooling towers have an amount of wetted deck surface equal to that of the previous line. According to the manufacturer, space economies have been effected by more efficient utilization of the air and water and effective inter-facial contact areas.



Cooling Tower



Evaporative Condenser

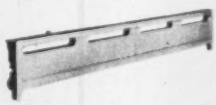
Built with centrifugal blower wheels, they are suitable for installation wherever inlet or outlet duct connections might be required. Condensers are offered in various sizes from 5 to 75 tons, and the cooling tower sizes range from 3 to 75 tons. Eliminator sections in condensers of 20 tons and above and in all cooling towers are constructed of 24 ga zinc coated steel in a Z type section. Condenser "Freon" coils are constructed of ¾ in. copper tubing, with all joints silver soldered. Coils for ammonia are ¾ in. steel tubing, hot dipped galvanized. Wetted deck surfaces in the cooling towers are constructed of 24 ga zinc coated, painted steel, and surfaces are removable in sections.

Baseboard Heating Panels

HPAC 7—Weil-McLain Co., Michigan City, Ind., is offering its new cast iron "Snug" baseboard panels, designed to provide a combination of radiant and convected heat.

The front of the panel is water backed and supplies radiant heat to the room; the back is finned and provides convected heat through slots in the top of the panel.

Panels are 7¼ in. high and 2⅛ in. wide. They are made in 1 and 2 ft sections joined together by nipples and tie bolts. They are shipped assembled in increments up to 6 ft and may be assembled into larger panels on the job by the use of clamps. Metal accessories for finishing installations are available, including matching metal baseboard.



Heating Panel

Flow Interlock

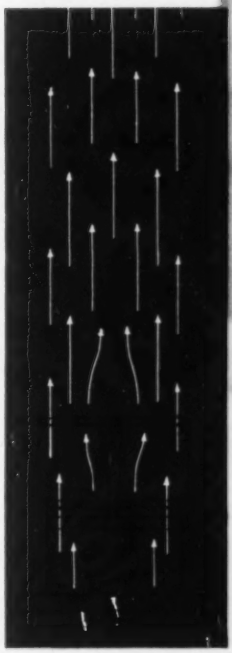
Flow Interlock

HPAC 8—An improved flow interlock, a device which responds to a flow of water to open or close an electrical contact, has been developed by the control divisions of General Electric Co., Schenectady 5, N. Y.

The new design is said to include a fine differential,

To Ventilate New 17 Acre Plant LINCOLN ELECTRIC SELECTS DeBOTHEZAT ROOF VENTILATORS

Outside Cleveland, a plant that reflects an entirely new concept of production houses the Lincoln Electric Company. Designed by The Austin Company, it embodies many radically new features to reduce manufacturing costs and speed production of Lincoln arc welders and electrodes. 54 DeBothezat Roof Ventilators provide controlled ventilation and help maintain the worker comfort and efficiency for which Lincoln is famous.



CONTROLLED VENTILATION--REGARDLESS OF WEATHER

DeBothezat Vertical Discharge Roof Ventilator is a motor-Driven fan in a weatherproof housing, guaranteed to provide positive ventilation at all times. Available with fan wheels 36", 42" and 48" in diameter, with capacities up to 40,900 cubic feet of air per minute.

For illustrated bulletins on these and other DeBothezat fan units, write our factory, Dept. H.P. 550, or phone your local DeBothezat agent.

DeBOTHEZAT FANS DIVISION

American Machine and Metals, Inc. • East Moline, Illinois

We doubt that you've worked on many clubhouses like *this* one lately.

We haven't helped heat any, either.

But we *can* help heating engineers and contractors provide the proper thermal environment for any client—anywhere—in any kind of structure.

We have a lot of literature on the automatic control of all phases of heating, ventilating and air conditioning. Information you should have in your files.

And we have a lot of very well-informed control engineers—in our 89 different offices—who have a lot *more* information right at their finger tips.

We sincerely believe we can help you on any project that poses problems of control of any kind—for *control* is Honeywell's business.

So, why not *talk to Honeywell?* Why not *write* to Honeywell for complete information on the equipment discussed across the page? And why not do it *now?*

MINNEAPOLIS
Honeywell
First in Controls

union fittings at both ends, a bronze piston, reduced size and weight, simple adjustment, and more wiring space. In operation, it closes a contact when a flow of water exceeds a preset amount and opens when the flow falls below the preset amount. It can be used as a safety device in many applications, including hot water heaters, welding units, transformer cooling, induction heating, water-cooled dynamometers, etc. A single adjustment screw is used to set the circuit for any flow from ½ to 4 gpm. The flow differential between the cut-in and cut-out points of the electrical contact is 0.1 gal maximum. The interlock does not control the amount of water flow. This can be accomplished, if desired, by installing a throttling or regulating valve ahead of the device which is intended only for use with cold water. For use with hot water or other fluids, the manufacturer should be contacted for detailed information.

Rubber Lined Valve

HPAC 9—Developed for emergency gas or liquid shutoff service, cast iron valve No. 763 is rubber seated. With the angular seating vane for wedge type closure, the rubber is compressed around the periphery of the vane to give positive shutoff, even around the shaft bosses. This type of construction is said to make possible the use of an iron body valve in service that would normally call for stainless steel or other alloys. The manufacturer is R-S Products Corp., 4600 Germantown Ave., Philadelphia 44.

The valve is cycled and operated by a directly connected motor driven pump, sealed in oil. Hydraulic pressure raises the counterweight for the open position. When the valve is fully open, the operating motor is cut off by an integral switch. While the operator is energized, current consumption drops to a minimum. Should current fail, the oil operator is released, the counterweight drops and the valve is closed. Valve action can be reversed and available sizes range from 2 to 72 in.

Electrostatic Filters

HPAC 10—Trion, Inc., McKees Rocks, Pa., manufacturer of electrostatic filters for air and other gases, is now offering a complete "enclosure" for all of its built-up commercial and industrial type units.

Advantages of the new enclosure are said to include the fact that it is a completely integrated enclosure consisting of heavy sheet metal paneling throughout; it is easily accessible through access doors which have built-in door interlocks and time delay switches which cut off all power to the equipment before the doors can be opened; all component parts are included; and it can be easily specified and installed.

Cleanout Valve for Buried Tanks

HPAC 11—The safety cleanout valve of Liquidepth Indicators, Inc., Subsidiary of Petrometer Corp., 1 Star Square, Long Island City 1, N. Y., is designed to eliminate the possibility of explosions and fires in garages or other buildings where volatile, inflammable liquids are stored in buried systems.

The cleanout valve is a combination of three valves, each operating independently and automatically. Between cleanouts the cabinet or cover of the unit is locked.

In apartment buildings, for example . . .

Question: Is there any way to control the temperature in an apartment building so that all tenants will be satisfied at the same time?

Answer: There certainly is — by installing Honeywell Personalized Heating Control. With PHC, each apartment has its own individual thermostat — so each tenant can select the temperature most comfortable for him.

Question: But we've got to consider fuel bills. Won't they go up — with tenants free to regulate their own heat?

Answer: On the contrary, they'll go down — as much as 20% annually! Surveys show owners often have to overheat a whole building to satisfy the 10% who like to live at 76°. Yet, most tenants want no more than 72°. Their PHC will regulate to that temperature — and save your client money.

Question: How about the added cost of PHC? Is individual control equipment more expensive to install than ordinary equipment?

Answer: Initially, Personalized Heating Control does cost more — although probably less than you think. But PHC is *not* just an added cost. It's an *investment* that pays definite, worth-while dividends. Experience has shown tenants will gladly pay a little extra for the greater comfort individual controls give. In just a few years this extra will pay for the installation. And from then on, added income will benefit your client.

Send detailed information on Personalized Heating Control for apartment buildings.

Name _____ Firm Name _____

Address _____

Send this coupon today to Dept. HP-5-83, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

First in Controls

Ready power for your hand pipe tools with RIDGID

Legs, handy tool tray and fittings at slight extra cost.

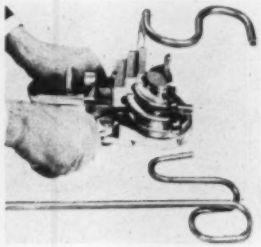
• Cut and thread more pipe faster, more easily with efficient No. 400. Lightest power unit made—one man can move it around on the job. Universal motor —forward, reverse, light socket power. RIDGID 3-jaw chuck, with chuck wrench ejector; self-centering workholder in rear turns with pipe. Sealed-in lubrication. Plenty of power, pays for itself in time and work saved in hand tool threading, cutting, reaming. Ask for the RIDGID "400" Power Drive at your Supply House.

RIDGID
Work-Saver Pipe Tools

In this normal position the valve connects the company's tank gage with the tank bottom. A separate float check protects both valve and gage in case of flooding or overfill, and also prevents pilfering of tank contents. When the lock has been removed and the cover tilted back, a knurled cap, chained to the cabinet, is exposed. Removal of the cap exposes a threaded connection for the pump hose coupling. At this stage the tank gage and tank itself are sealed from the atmosphere. Only when the pump hose coupling is tightly secured will the valve inside the exposed thread be open to connect the tank to the pump. At this stage there is a ½ in. passageway for removal of water or sludge. The tank gage, however, remains automatically sealed from both the system and the atmosphere. When cleanout is complete, the pump hose is uncoupled, the knurled cap is replaced, the cover is swung down into place, and the cabinet cover is locked for security and safety.

Bender for Light Tubing

HPAC 12—Tal Bender, Inc., Milwaukee 2, is offering a new model 1200 bender for making offsets and bends up to 180 deg in ⅜ in., ½ in., and ⅝ in. OD K and L copper tubing, brass, "Bundyweld" tubing, steel and other light gage tubing. The device is especially recommended for use in connection with refrigeration tubing, radiant heat coils, etc.



Tube Bender

Thermostat

Air Conditioning Thermostat

HPAC 13—Johnson Service Co., 507 E. Michigan St., Milwaukee 2, has developed a new proportional action, capillary heating-cooling thermostat for air conditioning control.

This T-271 thermostat is designed primarily for control of the return air temperature in a conditioning unit where both the heating and cooling media are regulated by a single valve or damper. The thermostat is mounted inside the air conditioning unit, with adjusting knob and dial either concealed or exposed. A remote bulb, connected to the thermostat by a capillary tube, is mounted behind the recirculated air grille.

During the heating season the controller operates as a direct acting thermostat. The action is reversed during the cooling season when it opens a normally opened valve or damper on rising temperature. The change in action of all, or any number of, thermostats in a building is accomplished by changing the pressure of the compressed air which is supplied to them. The thermostat is applicable to a variety of automatic control arrangements and types of air conditioning units. Temperature limits are 50 to 185 F, with a range of 20 F.

plumbers builders and home owners

profit by installing

Streamline®

ALL COPPER SUPPLY AND DRAINAGE PLUMBING

plumbers

The net profits on a STREAMLINE all-copper rough-in are substantially better than on a ferrous system when installed by experienced mechanics. Solder joints make installation much easier, and besides, copper plumbing is in demand by builders and home buyers.

builders

The permanence of a STREAMLINE copper system appeals to home buyers. It costs no more, installed, than a rustable ferrous system. It eliminates complaints because it is permanently trouble-free!

home owners

Copper plumbing protects the owner's investment—the resale value of the building is actually better! At no extra cost the owner gets what he wants—a modern, dependable system—rust proof and virtually clog-free.

Copper is already on the critical list. For civilian purposes it will not be as generally available as we would all wish it to be. To get further information see your plumbing jobber. For illustrated product literature write for Catalog S-351 and W-250 describing the complete line of cast supply and drainage fittings and the complete line of wrought fittings through 4".

MUELLER BRASS CO. STREAMLINE PRODUCTS

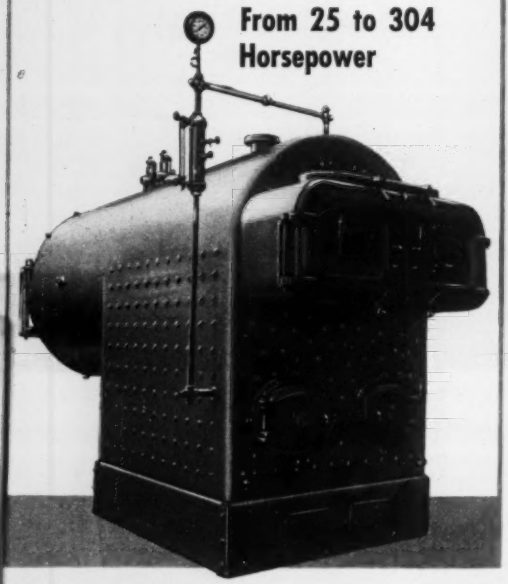
MUELLER BRASS CO., PORT HURON 1, MICHIGAN

In One Compact UNIT . . .

DEPENDABILITY

for every need . . .

From 25 to 304 Horsepower



TITUSVILLE

ALL-WELDED WP-WPO

Firebox BOILERS

The *only* all-welded, return tube, firebox type high pressure boiler—providing leakproof, troubleproof performance on continuous schedules for hospitals, institutions and industries. The Titusville Type WP-WPO Firebox Boiler is precision die formed and welded —built to ASME code with a 5-plus factor of safety—Standardized ratings, with large reserve capacity—gives excellent results with oil, gas or coal firing. Write for detailed, descriptive brochure.

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells TITUSVILLE, PENNSYLVANIA

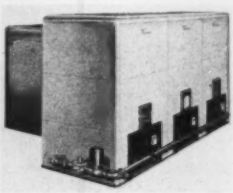
Representatives in Principal Cities

Forced Warm Air Furnaces

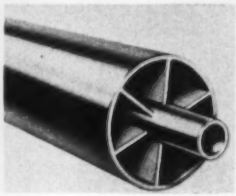
HPAC 14—L. J. Mueller Furnace Co., 2005 W. Oklahoma Ave., has added five new and larger sizes to its line of type 105 gas fired winter air conditioners. Ratings of the new sizes are 300,000, 360,000, 450,000, 540,000, and 675,000 Btu per hr input.

All sizes are approved by the American Gas Association for use with natural, manufactured and mixed gas, liquefied petroleum gas, propane-air gases, and butane-air gases. The construction of the new sizes is similar to that of the older models, except more than one heat exchanger is employed under one casing. A standard blower-filter unit is used together with a transition piece at the back to connect the furnace casing and the blower-filter unit. The units employ one gas burner manifold with individual safety valves and pilots for each burner.

The new sizes are especially recommended for apartments, schools, churches, and commercial buildings.



Warm Air Furnace



Concentric Tubing

Concentric Radial Fin Tubing

HPAC 15—A new two-fluid-pass heat transfer surface in the form of concentric tubing with radial fins is in production at the plant of Modine Mfg. Co., Racine, Wis.

Originally designed for a specific application involving low temperatures and high pressures, the new CRF tubing possesses characteristics which are said to adapt it to many other uses, such as gas liquefaction, food and pharmaceutical processing, condensing, exhaust heat recovering and heating requirements involving viscous materials. It can be fabricated of copper, steel, stainless steel, nickel and other metals in lengths up to 20 ft, and is suitable for a wide range of temperature and pressure requirements.

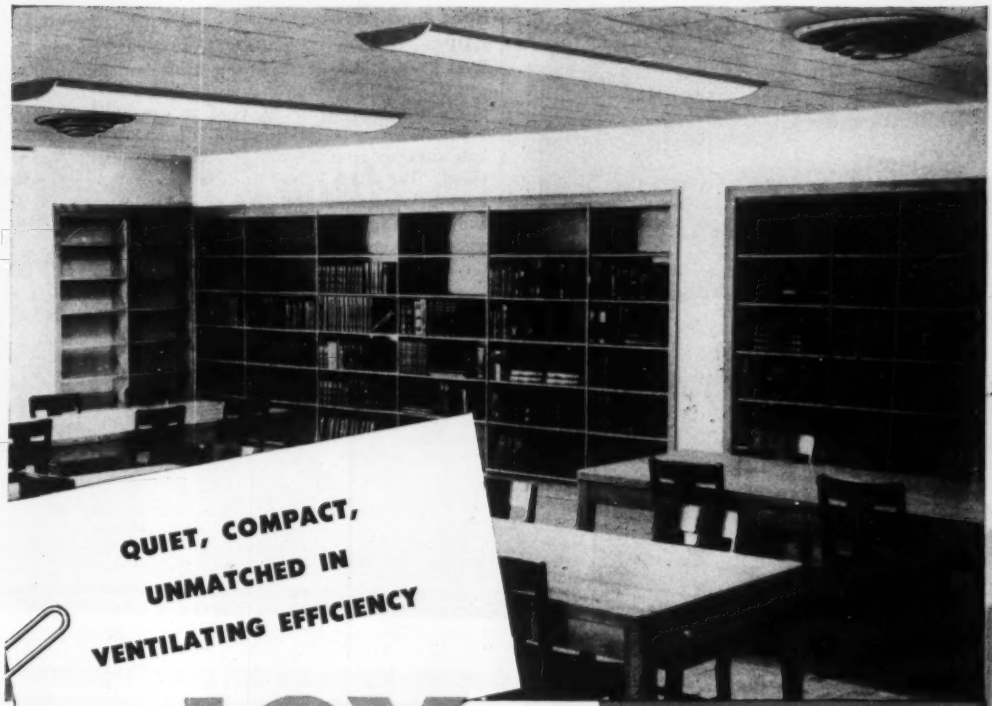
Intimate contact, says the company, is accomplished by means of fusion bonding of fin and tube elements. Tubing may be equipped with tee end fittings to provide easy connection to both passes, and it has been made with six radial fins, as shown, and in diameters of 1 in. and 1⅜ in. Tube geometry can, however, be modified to meet special product or process requirements.

Electric Radiant Heating Panel

HPAC 16—Appleman Glass Works, Bergenfield, N. J., has developed a new "Electriglas" radiant heating panel designed for rooms with limited wall space.

The unit is recessed into the wall and can be used with an optional built-in or a separate wall thermostat. It measures 56-½ in. high and 10-¼ in. wide, and is rated at 1000 watts, 110 or 220 volts.

The unit consists of two glass panels encased in a frame. The back surface of the glass (said to be virtually unbreakable) contains a chemical element which is fused into it. The surface of the glass reaches approximately 300 F.



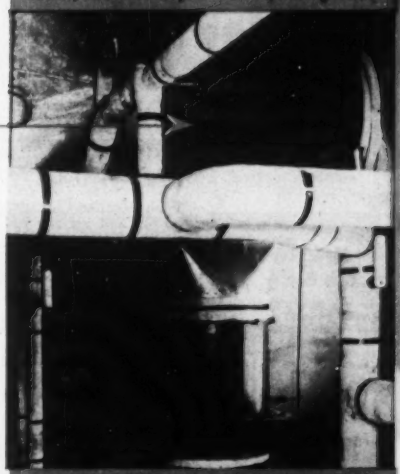
QUIET, COMPACT,
UNMATCHED IN
VENTILATING EFFICIENCY

JOY
AXIVANE® FANS

...BEST in Public Buildings

The compact, vaneaxial design of JOY AXIVANE Fans offers you important advantages of quiet, more efficient operation and savings on space requirements, installation costs, and power consumption. In addition, adjustable blades—a standard JOY feature—give you easy flexibility . . . you can make a simple on-the-job adjustment to meet new or changed conditions with greatest efficiency. ● For any ventilation job, check first with JOY—world's largest manufacturer of vaneaxial fans.

View in the Kansas Wesleyan Memorial Library, Salina, Kansas, ventilated with JOY Fans. Note ceiling louvers.



Wilson & Company, Engineers (Salina)—the consulting engineers—selected JOY Fans for this job. They mount right on the air duct, saving space and installation cost.

Write for Bulletin, or

Consult a Joy Engineer

W&D I 3520

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

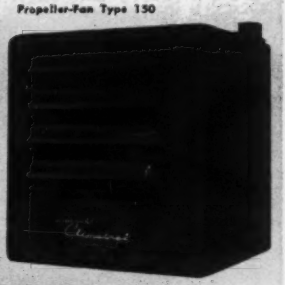
Approved

By AGA and UL — because they meet the highest standards of efficiency and safety.

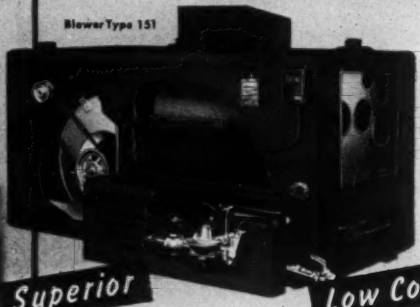
Specified

By architects, engineers, and builders because they — save space, save time, save construction costs.

Propeller-Fan Type 150



Blower Type 151



Superior

For long-life, efficiency, and economy because they are advanced in design, and quality built.

Low Cost

Competitive for any job because they are sized right, priced right.

Mueller Climatrol

unit heaters

Direct Gas-fired, Propeller Fan and Blower Types, Easy to sell...Easy to install!

Floor Model Type UH Unit Heater

Direct gas-fired. Ideal for factories, garages, etc. Designed for quick installation, efficient and economical operation. Sectional construction for capacities from 180,000 to 540,000 Btu input. AGA approved.

With Mueller Climatrol you can go out and get any job — where time and construction short-cuts are prime factors . . . where compact, efficient heating is in demand.

These design features give you a *real* selling advantage:

- ✓ **One piece, all-welded steel** — no joints to leak, separate, or crack.
- ✓ **High Crown sheet** — no "hot spots", no joints or welds exposed to flame or flue gas.
- ✓ **Uniform air flow and heat distribution** — insures maximum heat transfer and fuel economy.

Get behind the Mueller Climatrol unit heater. Sales come easy — installation is simple (units shipped pre-wired and assembled). Write for information . . . *L. J. Mueller Furnace Company, 2023F W. Oklahoma Ave., Milwaukee 15, Wisconsin.*

94th Anniversary

D-118A

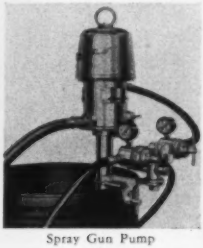
Mueller Climatrol

Hand Punch for Sheet Metal

HPAC 17—The new "Zing" hand punch offered by West Pacific Co., 1825 S.W. 6th Ave., Portland, Ore., is designed to cut smooth, accurate holes in various types of sheet metal.

It consists of an adapter ring which allows for two hole sizes, an anvil, a chisel guide and a specially shaped chisel. The punch is said to cut a 4 in. hole in stainless steel in less than 60 sec. It is available in various sizes and models for round, square or rectangular holes. Also available is a special tool for forming round holes.

Sheet Metal Punch



Spray Gun Pump

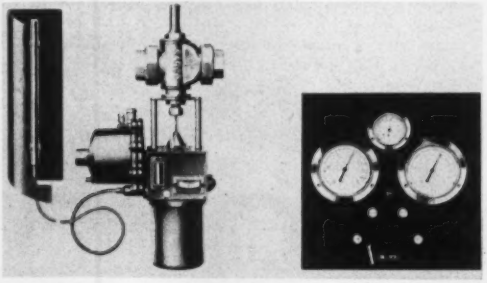
Spray Gun Pump

HPAC 18—Spray gun spurting, which may result in a blob of heavy industrial material being projected upon a surface being coated, is said to be eliminated by the new "Grace Powerflo" pump of Gray Co., Inc., Graco Square, Minneapolis 13.

This air operated material handling "Mogul" pump is equipped with a device called the "Evenflo" for preventing spurting. Operating in original 400 lb and 100 lb drums or in bucket-type containers, the unit is used to supply industrial materials through hoses for spray guns, pole guns, or extrusion gun applications. The unit is recommended for use in handling rust and corrosion preventives, calking compounds, adhesives, sound deadeners, undercoaters, and many other industrial materials. According to the company, gummy mastics and other non-self-leveling substances may be handled.

Modulating Control for Steam Heating

HPAC 19—The new "Sarcostat" type W control is essentially a modulating type valve for controlling the volume of steam to heating systems in relation to the outside temperature. The steam may be supplied directly to steam radiation or to converters used in connection with hot



water heating systems. The manufacturer is Sarcotherm Controls, Inc., Empire State Bldg., New York 1.

Finis

FOR THESE TROUBLEMAKERS IN PLANTS EQUIPPED WITH . . . . .

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVE**

Here's why

IN THE USERS OWN WORDS . . . . .

(Note how users' statements check against the 10 benefit points listed below)

FROM A TIRE COMPANY

"We installed your '1000' reducing valve in our re-capping set-up about six years ago and to this date we have had **trouble-free** service. Periodically I check steam **pressure** and find it to be very **accurate.** I wouldn't hesitate a minute in recommending your Streamlined Reducing Valve."

FROM A BUTTON MANUFACTURER

We use the type '1000' valves on one of the **toughest operations** and they have operated 24 hours per day for the past 2½ years with **no maintenance."**

FROM A GLASS MANUFACTURER

"We have one set of five pressure reducing valves (CASH STANDARD '1000') on a Hartford Empire ZU forehearth that have **operated accurately** and **trouble free** for five years **without** a dimes worth of **maintenance."**

FROM A LAUNDRY

"We are well satisfied. We get **accurate pressure control under toughest working conditions — trouble-free service — cost-saving operation and practically zero in maintenance costs."**

FROM A CHEMICAL MANUFACTURER

"We purchased our first CASH STANDARD Type '1000' Streamlined Valve six years ago and since then we have installed more than 200 of the '1000' valves ranging in size from ¼" to 1½". This is indicative of our complete satisfaction with the operation of the '1000'. A large number of the pressure reducing valves are **operating above your maximum specifications of temperature and pressure** with excellent results.

"The **elimination** of **steam leaks** and the **low maintenance** cost have been especially gratifying. The low initial cost, **low maintenance,** and **trouble-free** operation results in the **most economical** pressure reducing valve we have been able to purchase."

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

• ***WRITE FOR BULLETIN 962***

CASH STANDARD CONTROLS . . . VALVES

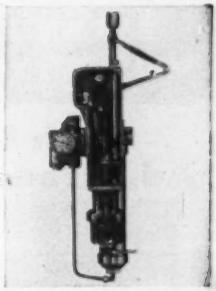
A. W. CASH COMPANY
DECATUR, ILLINOIS

•

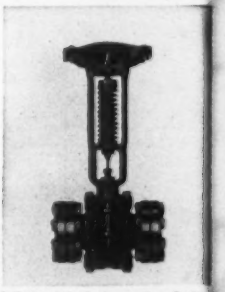
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

•



Bulletin 962 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

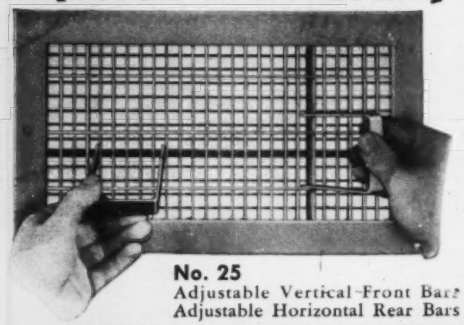
Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

INDEPENDENT

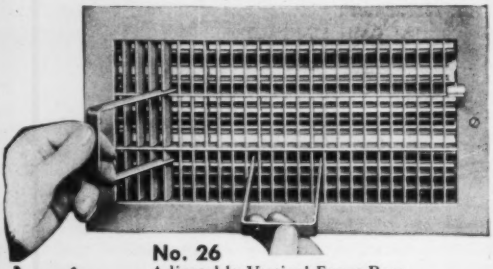
"Fabrikated"

DOUBLE CORE ADJUSTABLE BAR WALL GRILLES AND MULTIPLE VALVE REGISTERS

Each Grille Bar Adjusted Individually



No. 25
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



No. 26
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars—with Horizontal Multiple Valves.

Depth with valves closed 1⅞"
Depth with valves open 2¼"

write for new catalog no. 50

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION INDOOR COMFORT

Always Leading • Always Progressing

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET • CLEVELAND, OHIO

The device is designed to automatically feed only enough steam to balance the heat loss. The master control (shown at the left) is fitted on the main steam line or in each zone. The throttling position of the valve is determined by the outdoor bulb and also by the steam pressure existing in the system. A liquid-filled outdoor bulb acts to open the valve wider as the weather becomes colder. However, the valve is prevented from opening any wider than necessary to provide sufficient steam pressure for a given outdoor temperature. Steam or vapor pressure in the system is utilized to position the modulating valve at intermediate points and to automatically maintain predetermined pressures for different outdoor temperatures. Radiator orifice plates are furnished.

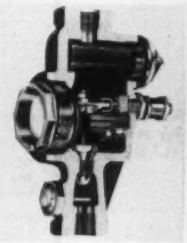
The control panel (shown at the right) includes a four position selector switch, an on-and-off switch, a dial thermometer, and pressure gages.

Steam Trap

HPAC 20**—An 8½ lb "universal" steam trap offered by Velan Engineering Co., 1 Exchange Pl., Jersey City, N. J., combines in one unit a trap, an air bypass valve, a check valve, a self cleaning strainer, a flow control glass, a temperature indicating gage, and a temperature control.

The unit is designed for pressures up to 650 psi and temperatures up to 1000 F. It is offered in one type and in one size, and according to the manufacturer replaces the range of many steam traps from ½ in. to 2 in. size. The valve is opened by steam pressure and is closed by thermal action. It is operated by a bimetal element as a function of the saturated steam curve.

The trap may be installed in any position and is said to be frostproof when in the vertical position. Because no extra check valves or other devices are needed, installation costs are said to be low.



Above: Insulated Plate Anchor

Left: Steam Trap

Insulated Plate Anchor

HPAC 21—Piping in underground insulated conduit can be isolated from electrical ground currents at anchor points by an insulated steel plate anchor developed by Durant Insulated Pipe Co., 1015 Runnymede St., East Palo Alto, Calif.

Designed to prevent longitudinal movement due to pipe expansion or contraction, the anchor is embedded in a concrete anchoring structure and the steel plate is kept from direct contact with the piping by being held in place between two attached plates of "Transite" asbestos cement.

The anchor is available in IPS sizes from ½ in. to 24 in., and in all conduit diameters.

Everybody's talking about

● THE NEW CHASE COPPER WATER TUBE CARTON

And no wonder! It's so convenient to ship . . . to use . . . to store . . . to identify. It's so sturdy that many sizes of tubes are packed several coils to a carton. That means a lot of steps saved on the job.

Chase Copper Water Tube is uniform in temper, making it easy to bend . . . corrosion resistant, giving it long life. It's light in weight, too.

For good, pressure tight connections with Chase Copper Water Tube, use Chase Solder-Joint Fittings.

Chase BRASS & COPPER

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Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
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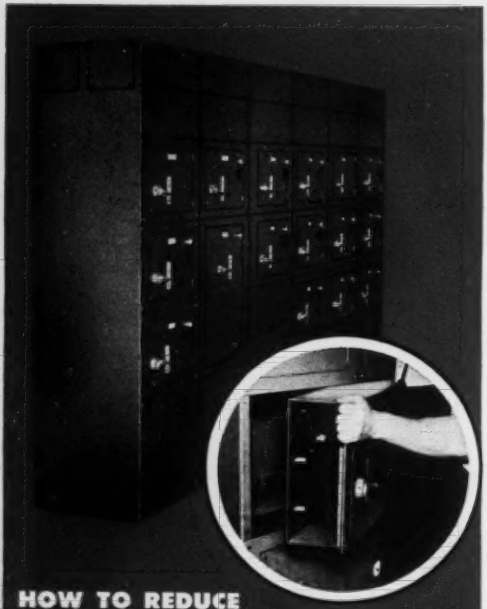
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)



HOW TO REDUCE
YOUR MOTOR CONTROL PROBLEM
TO ONE QUESTION—WHERE?

"Building-block" units permit grouping all motor controls at one point

You control *all* the motors in an entire area, floor or building—when you *centralize* the controls with Ward Leonard MULTITROL*.

Prefabricated MULTITROL units (each a complete control for one motor) fit into standard framework in any arrangement to suit the space. Units can be added, subtracted, interchanged, or relocated.

Some of the problems MULTITROL solves include: *Structural framework*—none needed, MULTITROL units are free-standing. *Obstructions*—no difficult cable or pipe forming, no chopping out walls. *Appearance*—no haphazard box mounting. *Safety*—completely deadfront construction.

Investigate MULTITROL. Wide choice of starter types, combined with externally-operated thermal circuit breakers. Write for Bulletin 4410. WARD LEONARD ELECTRIC CO., 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

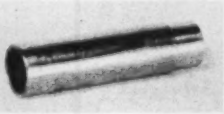
*Also available for D-C

WARD LEONARD
ELECTRIC COMPANY
Result-Engineered Controls Since 1892
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

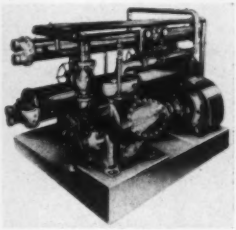
Duplex Tubing

HPAC 22—The duplex tubing of Bridgeport Brass Co., Bridgeport 2, Conn., is recommended for use where troublesome corrosion problems occur when tubing is attacked simultaneously inside and outside by two entirely different types of corrosive media. According to the company, suitable combinations are obtained by selecting a metal which will cope with the outside corrosion and another which will stand up against the inside corrosive conditions. Where it is necessary to prevent galvanic corrosion, the outside component is cut back and is replaced with a sleeve of the same composition as the inside component. (In the illustration, both ends are cut back, with a sleeve attached to one end).

One application of this tubing is in connection with ammonia refrigeration. In this instance, steel is used on the ammonia side, and copper or one of its alloys is used on the water or brine side of heat exchange equipment. Other applications are said to include boiler tubing, exchanger tubing for oil refineries, chemical and food processing, piping for conveying gas in corrosive soils, pump liners, etc. Combinations of metals include: Admiralty, aluminum brass, copper, copper-nickel, aluminum bronze, and silicon bronze combined with steel, stainless steel, aluminum, monel, nickel, lead, and tin.



Above: Duplex Tubing for Handling Two Different Types of Corrosive Media



Right: Reciprocating Machine for Air Conditioning and Refrigeration

Refrigeration Machines

HPAC 23—Two models of reciprocating refrigeration machines specifically designed for air conditioning and refrigeration use in the 100 to 150 hp range have been developed by Carrier Corp., Syracuse, N. Y.

The reciprocating machine, designated as model 30B, is furnished as a complete package with compressor, cooler, condenser, and all interconnecting piping, fittings, safety and capacity controls, gage board, and cooler and condenser stands included. According to the manufacturer, unusual compactness of assembly, provided through special design of pipes and fittings, reduces pressure loss to a minimum, guarantees excellent overall performance, and permits a wide range of applications where space is critical. The machine is particularly recommended for chilling water for air conditioning purposes, and is adaptable to many industrial requirements, including direct product cooling, brine chilling, and ammonia and chlorine condensing.

The compressors used in the 30B models are part of the company's standard list of reciprocating units. This list includes compressors ranging in size from 3 to 200 hp. Four and six cylinder compressors of the type built into the new machines may be obtained as separate units for use with either "Freon," ammonia or "Carrene 7" refrigerants in 75 hp to 200 hp applications. Other compressors now available include 2, 3, 4, 6 and 8 cylinder

models for use with "Freon" and for a range of 3 to 60 hp. The 4, 6, and 8 cylinder models may be obtained in various duplex combinations in 60 to 125 hp sizes.

WE HEAR THAT . . .

HOMER ADDAMS, chairman of the board, *FITZ-GIBBONS BOILER CO. INC.,* New York, cut a birthday cake during a recent celebration of the company's sixty-fifth anniversary.....Ground has been broken at Succasunna, N. J., for a vertical turbine pump plant of *WORTHINGTON PUMP & MACHINERY CORP.,* Harrison, N. J. The plant will manufacture pumps to serve customers east of the Mississippi River as well as customers abroad.

FAIRBANKS, MORSE & CO., Chicago, has discontinued the manufacture and sale of stokers and other heating equipment, but will continue to manufacture parts to service heating units now installed. *WORLEY HEATING SERVICE,* Chicago, has been appointed parts agent for the United States.

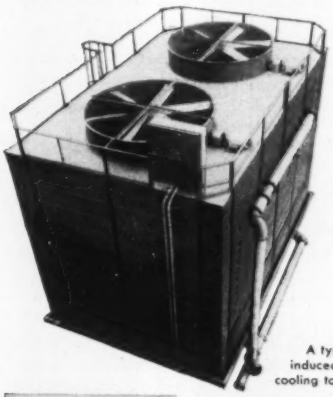
ARROW UTILITIES, Brooklyn, N. Y., recently opened its new enlarged headquarters. The air conditioning, fuel oil and heating firm is now an authorized air conditioning contractor for *WESTINGHOUSE ELECTRIC CORP.,* Pittsburgh.....*BLACK & DECKER MFG. CO.,* Towson, Md., is constructing a new 100,000 sq ft branch plant at Hampstead, Md. A contract has been awarded to The Austin Co. for the new facility, and it is expected that the plant will be in operation by next spring.

A new educational program designed to aid in the rapid training of industrial personnel in the selection and application of modern electric motor drives has been announced by *GENERAL ELECTRIC CO.,* Schenectady 5, N. Y. Fifteenth in the company's "More Power to America" series, the program consists of a course made up of nine 35 mm black and white slide films, student review booklets on each lesson, and an instructor's manual.

Each film has a running time of from 15 to 30 min, and is accompanied by a 16 in. sound recording of the script. The program was distributed last month to company district offices for showings to interested groups. The entire kit, consisting of nine slide films, one instructor's manual, and ten copies each of the nine student booklets, may be purchased from the company for $100.00.

Attendance this year at the *IBR SCHOOL OF MODERN HEATING* is running considerably ahead of the attendance last year, according to *R. E. FERRY,* general manager of the *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS.* The three day traveling schools are being conducted by the Institute.

A series of five-day schools dealing with the application, installation and servicing of "Janitrol" gas fired space heating equipment has been held at the Columbus plant of *SURFACE COMBUSTION CORP.,* Toledo. During the week of June 18 there will be a final session for dealers conducted by engineering division field men.



A typical Binks Type K induced draft cooling tower.

LOW COST WATER COOLING!

Binks mechanical draft cooling towers operate efficiently in close quarters

Every Binks cooling tower is designed to give you the correct air-to-water ratio for maximum cooling efficiency. Because Binks mechanical draft towers create their own air movement, they are ideal for difficult locations. Towers of this type are made by Binks with capacities from 3 to 1000 tons of refrigeration...a standard size and type for nearly every need, without the expense of special engineering. Binks towers are ruggedly built to provide long-life and low maintenance.

- Rigid steel frame, steel encased.
- Fans up to 144" diameter of corrosion resistant alloy. Variable pitch blades.
- Spray-filled or deck-filled construction.
- Easy to erect. Parts all shop fabricated.

Clog-proof Rotojet nozzles used exclusively in Binks towers are designed on the off-center inlet, whirl chamber principle. They assure maximum fluid break-up . . . maximum heat dispersal.

Send today for the following Bulletins:

No. 33—Type 2-D horizontal single fan towers. To 90 GPM
No. 34—Type 2-D horizontal twin fan units. To 300 GPM
No. 36—Type 2K-S spray-filled cooling towers. To 660 GPM
No. 37—Type 2K-W wood-filled towers. To 525 GPM
No. 39—Type K heavy duty towers. To 3000 GPM
Nos. 46 & 47—Types 2-B and 2-BB towers. To 180 GPM

THERE'S A BINKS TOWER FOR EVERY COOLING JOB

Binks MANUFACTURING COMPANY

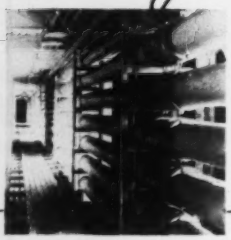
REPRESENTATIVES IN ALL PRINCIPAL CITIES ■ 3118-38 CARROLL AVENUE, CHICAGO, ILL.

Ultra-modern university campus an architectural masterpiece

DESIGNED *for tomorrow*

ENGINEERED *for tomorrow*

. . . Badger EXPANSION JOINTS . . . assure long, trouble-free life . . . an engineering masterpiece



This University with an expansive campus has erected ultra-modern buildings which are both *designed* and *engineered* for tomorrow. The structures represent the very latest trends in functional design . . . and the *steam distribution systems* must be *engineered* to perform with maximum efficiency. As you would expect, Badger Corrugated Packless Expansion Joints, constructed to the famous Directed-Flexing Self-Equalizing design, are first choice with contractors for these forward-looking universities.

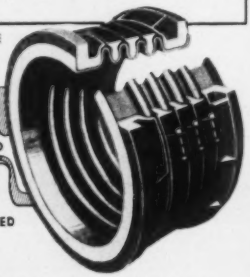
* * * * * *

What's the reason you find Badger Expansion Joints specified on *important* jobs? Because engineers have learned from years of experience to put their faith in the performance of Badger Joints . . . performance that's a result of construction features like these:

- Directed-Flexing Self-Equalizing rings . . . progressively control the movement of the all-curve corrugations.
- Packless . . . pressure-tight single tube — requires no maintenance.
- Compact . . . approximately the size of flanged fitting.
- Special forming . . . no structure-weakening stresses.
- Controlled heat treating . . . assures long life.
- Wide range of traverse — pressure — temperature.

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion.

WRITE TODAY FOR FREE 24-PAGE CATALOG SHOWING COMPLETE LINE



COLD

HEATED

Badger

MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE, MASS.

A giant C-82 flying boxcar of the U. S. Air Force attracted much attention recently at the Syracuse Municipal Airport when it flew from a southern Air Force base to pick up an evaporative condenser of *CARRIER CORP.* destined for an installation of military importance.

A defense order contract for the manufacture of high explosive artillery shells has been awarded *C. A. DUNHAM CO.*, Chicago, by the Army Ordnance Corps. Shells will be produced at the company's Michigan City, Ind., plant and production will begin this summer.

UNITED STATES AIR CONDITIONING CORP., Minneapolis, has appointed two new distributors for its window units. *RUMSEY ELECTRIC CO.* is handling representation in the Philadelphia area, and *PHILADELPHIA WHOLESALE DEALERS, INC.*, 46th and Girard Aves., Philadelphia, is covering an area including nine eastern counties in Pennsylvania and eight counties in southern New Jersey. The firm has a branch at Allentown, Pa.

HAJOCA CORP., Philadelphia, has contracted for a two week exhibit this spring and a similar exhibit next fall in the 30th St. station of the Pennsylvania Railroad, Philadelphia. The exhibition project is sponsored by the Chamber of Commerce.

FOXBORO CO., Foxboro, Mass., has added a new one story building, which represents a nearly 25 percent increase in working area, at its headquarters plant. The new building will be used principally for the final assembling and testing of equipment. In addition to this structure, a new training school building is being erected.

HAMMEL RADIATOR ENGINEERING CO., Los Angeles, has created a war plant division which comprises a modern machine shop and basic equipment for all types of sheet metal fabrications.....*OWENS-ILLINOIS GLASS CO.*, Toledo, has appointed *LUSE-STEVENSON CO.*, Chicago, distributor-applicator for its thermal insulation in the Chicago area.

BRONZE BEARINGS, INC., Cranford, N. J., has been organized recently to take over the manufacture and sale of bearings, bushings, and nonferrous castings formerly produced by *S & H BEARING MFG. CO.*, Cranford.

"Threshold treatment" of water to control corrosion, prevent lime scale, stabilize iron and manganese is illustrated in one of a series of graphic displays in the new reception room of the Hagan Bldg., Pittsburgh. Sponsored by *HAGAN CORP.* and its subsidiaries, *HALL LABORATORIES, INC.*, and *CALGON, INC.*, the displays indicate the variety of services performed by these companies.

BOWSER TECHNICAL REFRIGERATION DIV., BOWSER, INC., Terryville, Conn., has named *CONCOR INTERNATIONAL CORP.*, Passaic, N. J., exclusive export representative. As manufacturer and distributor of standard equipment, and as engineers and designers of special equipment, Concor handles air conditioning, refrigeration, and ice making equipment.

EDGAR MORRIS SALES CO., Washington, D. C., is a new distributor for the window units, console units, and store conditioners of *UNITED STATES AIR CONDITIONING CORP.*, Minneapolis. The firm has been active as an appliance distributor for a number of years and has recently expanded its commercial refrigeration and packaged air conditioning department.

NEW ENGLAND LEAD BURNING CORP., St. Louis, has installed a new type lead pipe extrusion press. It is designed to make lead pipe from ½ in. to 10 in. ID, and in standard wall thickness.....Last month, *MILWAUKEE VALVE CO.*, celebrated its 50th birthday. The plant now occupies two acres and includes a new foundry, built two years before World War II, and a new machine shop completed in 1949.

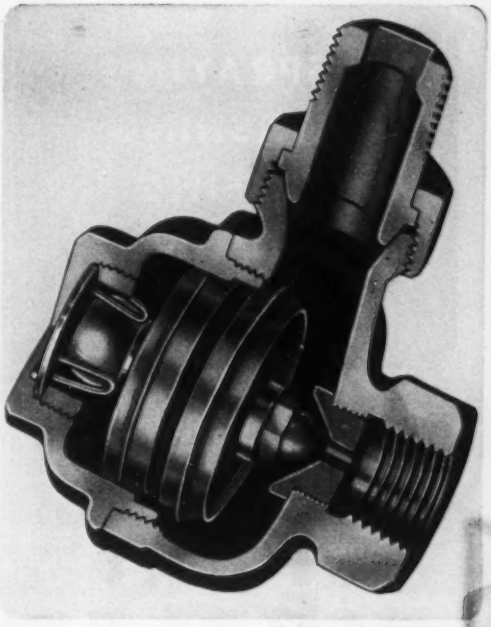
Abstracts of corrosion literature will be printed by the *NATIONAL ASSOCIATION OF CORROSION ENGINEERS*, 919 Milam Bldg., Houston 2, on McBee punch cards to reduce time needed to search literature for information. The 5 × 8 in. cards on which abstracts are printed have two rows of holes around their perimeter. Most of the holes have been allocated to the NACE abstract filing system with necessary indices printed adjacent to the holes. Other holes are left open for supplementary indexing by subscribers to the card service who wish to add their own system. The cards are sorted by pushing needles through designated holes, lifting the stacks and shaking out the desired cards. The subscription rate for the 1951 calendar year is $75.00.

Automatic compiling of two measurements and plotting of a curve to show their interrelationship is made possible by a new "Electronik" function plotter developed by *BROWN INSTRUMENTS DIV., MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Wayne & Windrim Aves., Philadelphia 44. The instrument incorporates two measuring systems, one of which actuates a recorder pen while the other motivates the instrument chart.

A new electronic device, the "Digital Reader", has been developed by *ARTHUR D. LITTLE, INC.*, 30 Memorial Dr., Cambridge 42, Mass., to read test instruments at speeds up to 50,000 readings per second and record the readings on tape or punched cards for computation. The instrument is recommended for use in recording and computing from strain, pressure, acceleration, or temperature gages, and pilot plant and other physical and control instruments used in research work.

Refrigerating Principles and Practices, a textbook designed for *CALIFORNIA STATE POLYTECHNIC COLLEGE* students in air conditioning and refrigeration and written by *NORMAN SHARPE*, head of that department, recently passed the 5000-copies-sold mark, and a second printing is now under way at the McGraw-Hill Book Co., New York.

W. H. BRADY CO., 16 E. Spring St., Chippewa Falls, Wis., is offering a line of colored wire markers made of silicone treated cotton cloth with an adhesive backing. They are used for color coding electrical wires.



Built for Long Life in Medium and High Pressure Service

For steam pressures between 15 and 100 pounds gage, your safest choice is a B & J Medium or High Pressure Thermostatic Trap. These traps are especially effective for use with coffee urns, sterilizers, general cooking apparatus, process fixtures and laundry equipment where pressures exceed 15 pounds.

Heavily constructed, B & J Medium and High Pressure Traps are designed particularly for such uses. Removable stainless steel seat and monel valve piece, the only parts that will ever wear out — thermostatic element and seat — can be replaced quickly and easily.

And remember, too: every single item produced by Barnes & Jones is thoroughly and exhaustively checked and must pass our most exacting requirements before it ever leaves our plant. Moral: you're *bound* to be *right* with Barnes & Jones.

B&J

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Representatives in all principal cities

for • SPRAYING
• WASHING
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• AIR CONDITIONING

YARWAY

SPRAY NOZZLES

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for new Bulletin N-616.

YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

WHO'S WHAT

JOHN E. HAINES has been named president of the recently formed appliance controls division of *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis, and will continue as the company's vice president in charge of the commercial controls division. The newly created post of regional sales manager, commercial division, for the Rocky Mountain region, will be filled by *J. R. WILSON*, formerly district representative in Sioux City, Iowa.

To handle the firm's activities in defense construction (particularly the atomic energy, aviation engine test cell, and industrial building construction markets) the company has formed a new division headed by *V. D. WISS-MILLER*, formerly supervisor of refrigeration and national accounts, who will remain at Minneapolis. He will be assisted there by *J. H. RASCH*, sales engineer for the company since 1947, and in the eastern section of the country by *O. F. QUIST*, who has been a member of the sales staff in the New York office. *GEORGE A. LANGENBERG* is now market supervisor of defense installation projects coordinating commercial division activities involving Armed Forces installations.

The board of trustees has appointed *ROSS J. MARTIN*, associate professor of mechanical engineering, to the associate directorship of the *UNIVERSITY OF ILLINOIS ENGINEERING EXPERIMENT STATION*. He will be liaison man between the station and agencies sponsoring many of its investigations.

RODNEY F. LAUER, a pioneer in the development of high altitude chambers and all-weather rooms for the Armed Forces and manager of the company's Pacific district since 1944, has been named vice president in charge of engineering and research for *YORK CORP.*, York, Pa. *J. H. SKIPPER*, formerly sales supervisor in the Charlotte, N. C., area, is now commercial sales manager of the firm's southern district. *JOHN L. ROTH*, who joined the company last year, has been named to a similar post for the central district.

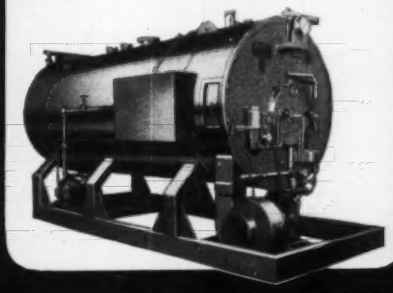
CAPTAIN THOMAS H. URDAHL, USN (ret.), has been elected vice president of *W. B. CONNOR ENGINEERING CORP.*, Danbury, Conn. He has been active in the design and development of electrical and power equipment and systems, particularly in the field of heating, ventilating and air conditioning, over the past 25 years. During World War II he was chief of the air conditioning section of the Navy's Bureau of Ships.

ARNO C. FIELDNER, associated with the *BUREAU OF MINES* for over four decades, is now chief fuels technologist and is serving as advisor, technical specialist, and general authority for the bureau. For many years he was chief of the fuels and explosives division. *LOUIS C. McCABE*, assistant chief of the division for two years and also chief of air and stream pollution prevention research, is the new head of the fuels and explosives division.

AUTOMATIC STEAM GENERATION

AMESTEAM GENERATOR

. . . a Compact, Self-Contained Unit



- FULLY PIPED AND WIRED
- FACTORY TESTED
- 80% EFFICIENCY

Oil, Gas or Oil-Gas Combinations
10 to 500 h. p.
15 to 200 lbs.

WRITE FOR BULLETIN TODAY!

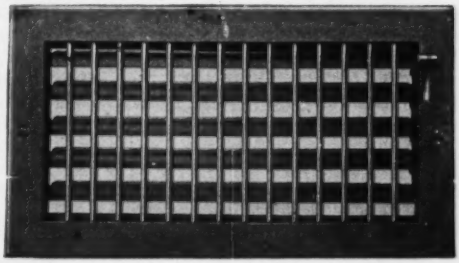
AMES IRON WORKS

BOX 2005 OSWEGO, N. Y.

Builders of Better Boilers since 1848
Manufactured under
License in Canada by VOLCANO, Ltd., Montreal, P. Q.

AUER "Streamliner"

Multiple Deflection Air Conditioning REGISTERS and GRILLES for High Velocity Outlets

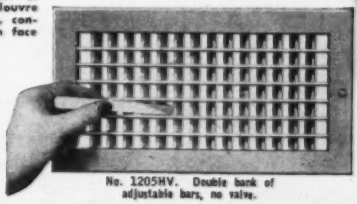


No. 1005V-HML. Single bank of adjustable bars, multi-louvre valve.

For beauty, efficiency, and flexibility in modern air conditioning, ventilating, and cooling systems — get Auer Streamliners. In these highly perfected registers and grilles, the bars are hollow molded, beveled, carefully formed, smooth in contour. Each bar is pivoted in frame on special split sleeves, or "expansion" inserts, furnishing proper tension to hold bar firmly in position (and maintain silence when register is in operation at high velocity) yet readily adjustable to any desired angle. Bars have "tear-drop" shape in cross-section, somewhat like an airplane wing, and being pivoted at the exact center, may be completely reversed. This permits you to turn the *thin* edge outward, if you wish (and the *broader* edge toward air-flow) cutting resistance and turbulence to the minimum. Bars may be set in any grouping, and repeated adjustments are not likely to affect their rigidity when set. Shutters of multi-louvre control valves are pivoted on rivets to prevent any vibration. All Streamliner registers equipped with gaskets. Write for Folder S-50 with sizes and prices.

8 MODELS

The Series includes models with single bank of adjustable bars (vertical or horizontal), also with double bank of adjustable bars (vertical in front and horizontal in back, or the reverse), also all above four types with the addition of horizontal multi-louvre valves in the rear, controlled by lever on face of register.



No. 1205HV. Double bank of adjustable bars, no valve.

Complete Auer Register Book — or Catalog "G" on perforated grilles — sent on request.

The Auer Register Co., 6600 Clement Ave., Cleveland 5, Ohio

Auer REGISTERS
& GRILLES for AIR CONDITIONING & GRAVITY

LESLIE M. CASSIDY has been elected chairman of the board and chief executive officer of *JOHNS-MANVILLE CORP.*, New York. He joined the company in 1926 and has been president since last February. He succeeds the late *LEWIS H. BROWN*. *ADRAIN R. FISHER*, who recently was named a director and vice president in charge of asbestos mining, is the new president.

Other appointments include two vice presidents — *WILLIAM R. WILKINSON*, for sales, and *KENNETH W. HUFFINE*, for production — and two industrial products division managers — *C. A. de VYVER*, insulations, and *DUANE D. CREWS*, construction.

CARROLL M. BAUMGARDNER, vice president and director of National Radiator Co., is now consultant to the heating branch, building materials division, *NATIONAL PRODUCTION AUTHORITY*.

CECIL BOLING, associated with *BUSH MFG. CO.*, West Hartford, Conn., for the past 11 years, has been elected vice president and general manager. He has been sales representative of the company in its eastern territory, operating through his own organization, Cecil Boling Co., N. Y., founded in 1940. In 1945 he started Heat-X-Changer Co., Brewster, N. Y.

CHARLES R. NEESON, refrigerating consultant for Airtemp Div., Chrysler Corp., has been made a Fellow of the *AMERICAN SOCIETY OF REFRIGERATING ENGINEERS*. He is the 41st member to receive this honor.....*J. L. MAUTHE*, president, Youngstown Sheet and Tube Co., is the 1951 recipient of the David Ford McFarland Award for achievement in metallurgy. The award was established in 1949 as an annual recognition to a metallurgy alumnus of *PENNSLYVANIA STATE COLLEGE*.

ALFRED S. SAMPIERRE is the new vice president in charge of manufacturing and engineering operations for *JACKSON & CHURCH, CO.*, Saginaw, Mich. He fills the vacancy left by the death of *CLARENCE AHLBORN* and he recently resigned from Baker-Perkins Co., with which he had been associated for 21 years.

Recently elected officers of *KROESCHELL ENGINEERING CO.*, Chicago, include: *ARNOLD H. GOELZ*, chairman of the board and treasurer; *ROBERT A. KROESCHELL*, vice chairman of the board; *PAUL H. KROESCHELL*, president; *HANS A. STADE*, executive vice president; *WILLIAM F. CHRISTMANN*, *HARRY M. COESFELD*, *M. FELIX KOSTER*, and *THOMAS F. McCARTHY*, vice presidents.

T. A. CRAWFORD, vice president, Timken Silent Automatic Div., Timken-Detroit Axle Co., is now president of the *OIL-HEAT INSTITUTE OF AMERICA*. *P. K. ADDAMS*, president, Fitzgibbons Boiler Co., and *H. H. WILKINSON*, president, Herco Oil Burner Corp., are new vice presidents. Mr. Crawford succeeds *A. T. ATWILL*, president, Quaker Mfg. Co.

For DEFENSE ... use **STEDCO FIN-TYPE RADIATION** ... with Aluminum Fins

AGAINST CORROSION

A NON-CORROSIVE HEATING ELEMENT

STEDCO fins are attached to the tubing in an inter-locking sleeve fashion and completely encase the center tubing. This makes a non-corrosive heating element plus giving a double contact surface area between fin and center tubing resulting in longer life and outstanding high heat capacity. One lineal foot of Stedco radiation with aluminum fins will give 1930 B.T.U. or 8 sq. ft. of E.D.R. per hour. Stedco radiation is also manufactured with steel fins.

Manufacturers of STEDCO *Compact Convectors*

Immediate delivery on Aluminum Fin Radiation

HIGH HEATING CAPACITY

For Industrial, Commercial and Institutional installations where top performance is demanded!

A STEDCO INSTALLATION

U. S. Veteran's Hospital
Wilkes-Barre, Pa.

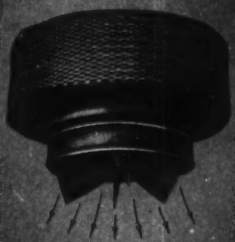
Stedco radiation was the choice for this hospital where economical, dependable heating is a prime requisite. Stedco met and passed the rigid specifications and requirements.

McCORD
HEATING AND AIR CONDITIONING PRODUCTS

BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

McCord CORPORATION
DETROIT 11, MICH.

When you consider VENTILATORS

Ask for PROOF OF PERFORMANCE!

Claims are a dime a dozen in the ventilating field. The only way to be *sure* of what you're buying in *any* make of ventilator is to insist on certified capacity ratings derived from tests made with the wind blowing against the ventilator in *all* directions as shown below. True performance under actual operating conditions can be determined only by such tests!

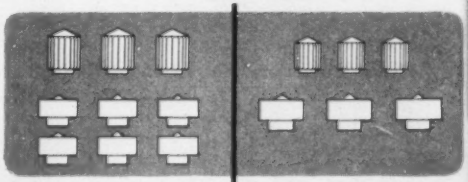
Patent No. 2269428

Breidert Air-X-Hausters

give you CERTIFIED and Published Capacity Ratings

Breidert ratings *are* based on tests made with wind blowing in all directions.* No matter which way the wind blows, barring interior negative pressures, the Breidert provides safe, sure ventilation . . . on roofs, vent flues, chimney tops. Stationary, no moving parts, nothing to jam or get out of order

HOW YOU CAN GET BETTER RESULTS WITH LESS MONEY



It takes fewer Breiderts to do the job as same size conventional ventilators. (or) *You can use the same number of smaller size Breiderts to do the same job as conventional ventilators.*

Get *all* the facts! Write today for complete Engineering Data Book, including certified capacity ratings. Address Dept. A.

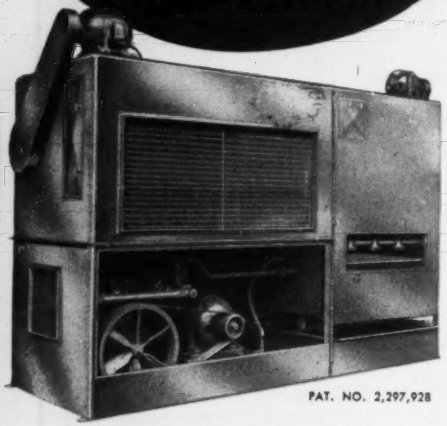
**By Pittsburgh Testing Laboratories*

THE G. C. BREIDERT CO.

3129 San Fernando Road, Los Angeles 65, Calif.

Representatives in principal cities throughout the U.S.

For day in, day out
DEPENDABILITY
you can't beat a
GOVERNAIR
COMPLETELY PACKAGED
AIR CONDITIONER

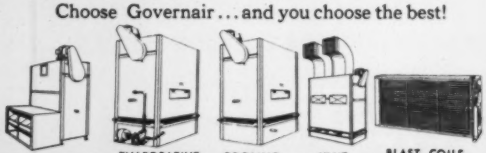


PAT. NO. 2,297,928

Name your job . . . any air conditioning job requiring from 3 to 50 tons . . . and you'll find that you can't beat a Governair system for day in, day out dependability.

Governair Packaged Air Conditioners are designed to operate at peak efficiency—with all parts precision-matched to work together. And they're built to give years and years of low-cost, trouble-free service.

Choose Governair . . . and you choose the best!



AIR CONDITIONERS | EVAPORATIVE CONDENSERS | COOLING TOWERS | UNIT COOLERS | BLAST COILS FOR HEATING AND COOLING

GOVERNAIR

WILLIAM J. O'NEIL, who has managed the Chicago operations of *IRON FIREMAN MFG. CO.*, Cleveland, for the last 15 years, has been elected chairman of the board and chief executive officer. *C. T. BURG* is now vice president in charge of sales; *E. C. WEBB*, vice president in charge of research and development engineering.

LEWIS J. COX is the new vice president in charge of public and employee relations; *JACK L. JENNINGS* is vice president in charge of operations. *FRANK S. HECOX* continues as vice president and treasurer; *C. W. SNIDER*, as secretary and controller.

W. A. SHOUDY, New York consulting engineer, has been appointed executive manager of the *COOLING TOWER INSTITUTE*, with headquarters at Basking Ridge, N. J. He has taught at Stevens Institute and Columbia University, and has had wide experience in both public utilities and industrial plants.

Formerly vice president and general manager of *GOLDEN-ANDERSON VALVE SPECIALTY CO.*, Pittsburgh, *GRANT A. COLTON* has been elected president. . . . . *JOHN R. HARTLEY* is now vice president of *BUILDERS-PROVIDENCE, INC.*, Providence, R. I. He joined the company as an apprentice draftsman 23 years ago, and most recently has been manager of project sales.

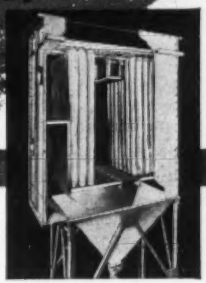
KEN L. CRAPEAU, export sales manager of Airtemp Div., Chrysler Corp., has been elected chairman of the foreign trade committee of the *AIR CONDITIONING & REFRIGERATING MACHINERY ASSOCIATION*. *C. E. RENNINGER*, sales manager, international division, York Corp., is vice chairman.

Two officials of Carrier Corp., Syracuse, N. Y., have been appointed to posts in the *DEFENSE PRODUCTION ADMINISTRATION*, in Washington. *GEORGE N. LILYGREN*, a company vice president and head of its coordinating committee, will be an assistant to the director of program and requirements. *DAVID W. HOPPOCK*, dealer sales manager for the New York, New Jersey, and Connecticut area, is now serving as special assistant in the office of the DPA administrator.

MARK W. CRESAP, JR., management consultant and co-founder of the New York and Chicago consulting firm of Cresap, McCormick and Paget, has joined *WESTINGHOUSE ELECTRIC CORP.*, Pittsburgh, as a vice president and assistant to *GWILYM A. PRICE*, president. Recent managerial appointments at the company's New England district headquarters place *WALLACE B. STRATHDEE* in charge of the marine and industrial departments, and *H. RAYMOND BENSON* in charge of the transportation department.

The new manager of standard pipe sales for *YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio, is *PAUL B. BAIRD*, formerly assistant manager. His headquarters will be at the home office. He succeeds *GLENN W. CHRISTOPHER* who died recently. *CARL T. SELANDER*, who has been western representative for standard pipe products, will take over as assistant manager, with headquarters in Chicago.

10 reasons why DUSTUBE collectors are more efficient and dependable

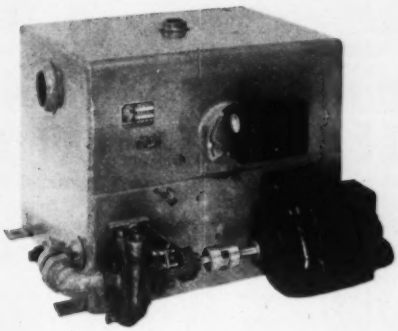


1. NO COARSE DUSTS REACH THE TUBES. Change of air velocity removes heavier particles first.
2. LOW COST CLOTH TUBES. Light and compact, they are easy to store and economical to ship.
3. SIMPLE INSTALLATION, RAPID TUBE REPLACEMENT. Only one man needed to install tubes.
4. EASY INSPECTION. Condition of cloth tubes readily determined without removing any parts.
5. LONGER CLOTH LIFE. No tension, no abrading metal contact, no coarse dusts to wear the tubes.
6. BRIDGING AND CLOGGING PREVENTED. Opening into filter bags is entirely unrestricted.
7. NO FILTER TUBE TENSION. No stretching and subsequent weakening of cloth fibers-longer life.
8. LOWER POWER COSTS. Ample expansion areas reduce air velocities and cut power requirements.
9. NO DUST LEAKAGE. Tubes are expanded tightly into cell plate to prevent dust leakage.
10. FAST, THOROUGH SHAKING. Tubes are shaken like a rug while limp and loose.

American dustube COLLECTORS

WHEELABRATOR & EQUIPMENT CORP.
619 S. Byrkit St., Mishawaka, Ind.

EAGAN "EAGLE" CONDENSATE PUMP



MATCH THIS FOR VALUE!
Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . 8,000 sq. ft. EDR at 20 PSI . . . and it's only **$139.00** (trade price). F.O.B. Phila.

Compare These Six Features

Mail coupon for full details

- Low inlet, 2" IPS, 12" from floor
- All bronze centrifugal pump
- Flexible coupling
- Standard ¼ HP capacitor motor
- Thermal overload protection
- Level indicating 2 pole float switch

WALTER H. EAGAN CO., INC.
Mfgs. of Condensate, Vacuum, Turbine, Boiler Feed and Centrifugal Pumps.
Pump Specialists since 1920

WALTER H. EAGAN CO., Inc. (Dept. B)
2336 Fairmount Avenue
Philadelphia 30, Pa.

SEND ME FREE DESCRIPTIVE BULLETIN OF THE NEW EAGAN "EAGLE" CONDENSATE PUMP

NAME .....
COMPANY .....
STREET .....
CITY ..... Zone.... State.....

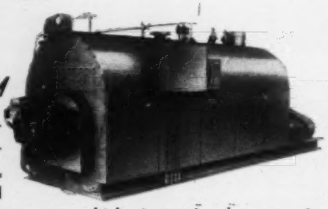
REDUCE! YOUR STEAM COSTS!

WITH A Dutton "PACKAGED"

STEAM GENERATOR

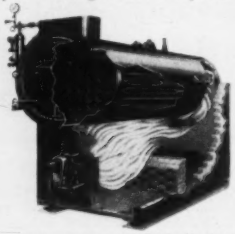
Dutton Steam Generators are QUALITY PRODUCTS, incorporating exclusive features of LONG LIFE, LOW OPERATING AND MAINTENANCE COST, MAXIMUM EFFICIENCY and SAFETY that only 71 years experience in boiler making can produce. Dutton Automatic "Packaged" Steam Generators are completely assembled — no special foundation or expensive chimney are needed.

Dutton EconoTHERM



Completely self-contained, automatically operated, 3-pass modified Scotch Internal Furnace type which gives twice the power in half the usual space. Features such as the Dutton Off-Center Firing and Rotary Combustion assure faster steam and more steam with less fuel consumption and greater safety. Burns gas or oil.

Dutton EconoMIST



A highly efficient horizontal return tube type, assembled in portable casing and ready for firing on arrival. Dutton improved shell design and double size full length, high bricked firebox, give faster steaming and longer steam carry-over with less fuel consumption. Burns oil, gas or coal with high efficiency — easily converted from one fuel to another. Available as a package unit with firing equipment, controls and mechanical draft with short stack.

Let us help select the best type for you.

Write for catalog HP-551 on "Packaged" STEAM GENERATORS.

Dutton BOILER DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO • MICHIGAN
Boiler Makers Since 1880

Officers elected at the recent annual meeting of the *PROPELLER FAN MANUFACTURERS' ASSOCIATION* are: *PARKER T. FINCH*, sales manager, Hunter Fan and Ventilating Co., president; *B. G. KRAUSE*, manager, Air Controls Inc., vice president; *L. O. MONROE*, Detroit, secretary and treasurer.

ROBERT C. TIERNEY, since 1948 coordinator in the vertical turbine pump division of *WORTHINGTON PUMP & MACHINERY CORP.*, Harrison, N. J., will head the vertical turbine pump plant at Succasunna, N. J., when it is completed.

The company has named *F. C. WINTER* manager of defense procurement and *C. W. CAMP* assistant manager. Mr. Camp has been an electrical engineer in the sales department, and Mr. Winter has been manager of stores for the Harrison works, a post which he will retain.

C. R. RIGBY, a group executive at the headquarters of *A. O. SMITH CORP.*, Milwaukee, has been named group executive in charge of the company's plant at Houston, Tex. *F. B. DUNN*, former manager of the Houston works, was recently placed in charge of personnel for both the Houston works, and the southwest district which covers eight states. *F. S. CORNELL*, plant manager at Kankakee, Ill., is now group executive for this plant, the eastern motor division at Tipp City, Ohio, and the heating division in Toledo.

MORRISON WAUD has been elected to the board of directors of *PYLE-NATIONAL CO.*, Chicago, succeeding his father, the late *E. P. WAUD*. He is a member of the law firm of Gardner, Carton and Douglas, general counsel of the company.....The new comptroller of *BAKER REFRIGERATION CORP.*, South Windham, Me., is *JOHN BRENNAN*, who for the past 10 years has held a similar position at the Kingsbury (LaPorte, Ind.) plant of Todd and Brown.

C. KEITH FERGUSON is now advertising manager of *KEWANEE BOILER CORP.*, Kewanee, Ill., and succeeds *EDWARD D. QUIRKE*, who has automatically retired in line with company policy for length of service. Mr. Quirke had been advertising manager for 27 years, and Mr. Ferguson moves up from the post of assistant manager which he has held since 1949.

RICHARD I. HANFORD, who joined *ILG ELECTRIC VENTILATING CO.*, Chicago, in 1914, has been named head of the engineering department. Recently placed in charge of divisions within the department are: *L. E. PETERSON*, research; *ELMO LARSON*, electrical; *FRED E. DRECHSEL*, design; and *JAMES O. O'BRIEN*, information.

CHESTER W. SCHWEERS is now director of sales for the general machinery division of *ALLIS-CHALMERS MFG. CO.*, Milwaukee. On the division's sales staff for more than 20 years, he was appointed manager of the New England region in 1950. Succeeding him in that post is *MERTON M. YORK*, formerly manager of the Boston district office. *STANLEY E. BROWN*, a sales representative in the Chicago district office, has been named manager

FRICK Air Conditioning Installed Here

This Duncan-Hines-approved Coffee Shop at Arlington, Virginia, uses two Frick unit air conditioners, each of 5-hp. size, to cool its dining rooms in summer. Two Frick refrigerating units also keep proper temperatures in four cold storage boxes—for fruits, vegetables and meats. Installation by Harvey W. Hottel, Inc., Frick Distributors in Washington, D. C.

There's a Frick system of the size and type to meet the cooling needs of YOUR business. Get estimates now.

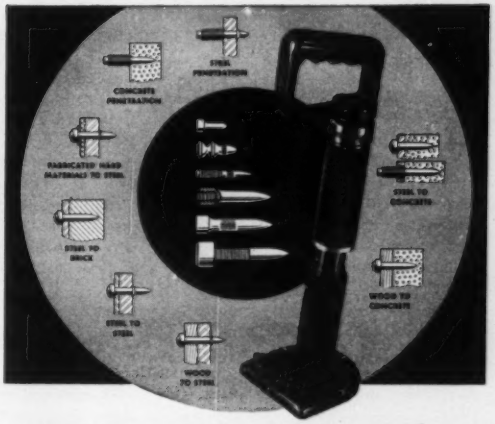
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

One of Two Frick Unit Air Conditioners at Evans Coffee Shop



HOW TO SAVE 14 MINUTES ON A 15-MINUTE JOB

That sounds like a difficult order, but RAMSET FASTENING SYSTEM will deliver it. Take fastening jobs like those illustrated, which are everyday work in almost any type of building—to anchor duct work, piping, controls, filter equipment, housings for blowers and condensing units . . . practically any heating or air-conditioning requirement.

Old-fashioned methods require 15 minutes or more, per fastener. With RAMSET SYSTEM you just READY! RAM! SET! in less than a minute from start to finish. Insert RAMSET FASTENER and power charge into the light, portable, self-contained RAMSET TOOL. Place it against the work and RAM! The fastener sets instantly. Quick, easy, economical RAMSET cuts costs 50% or more, saves precious time, and is so versatile you can use it for almost every fastening job into concrete, steel, other suitable materials.

Let us do a sample job to show you why RAMSET is so widely used in thousands of new buildings, or for extensions, repairs or alterations, to get the work done sooner, easier and at less cost. Write us or call your local RAMSET dealer for proof of how to save 14 minutes on a 15-minute job.

Ramset Fasteners, Inc.
12117 Berea Road
Cleveland 11, Ohio

Member of Producers' Council

Ramset Fastening System
Pioneer in powder-actuated fastening

of the division's new Peoria, Ill. branch office. *F. D. McGUIRE, JR.*, has been transferred from Chicago to the new office.

I. A. HUGHES has been elected vice president of *AFFILIATED GAS EQUIPMENT, INC.*, Cleveland, Ohio, and has been appointed general manager of the *BYRANT HEATER DIVISION*. He has been assistant general manager of Bryant since 1949. *ROBERT M. BUCK* succeeds *D. A. CAMPBELL* as manager of Bryant's industrial division. Mr. Buck has been engaged in industrial combustion developments since 1944. *FRANK L. EARLY* is now manager of the Bryant industrial division sales branch in Dallas.

CARROLL S. ANDERSON, of *E. I. du PONT de NEMOURS & CO. INC.*, Wilmington, Del., is the field project manager supervising construction of the company's new polyester fiber plant. He has headed many plant expansion projects since joining the company in 1936.

JAMES L. FOSTER, former sales promotion manager of its Blake Division, is now assistant sales manager of *HOFFMAN SPECIALTY CO.*, Indianapolis.....Sales manager for the new fiber glass division of *LIBBEY-OWENS-FORD GLASS CO.*, Toledo, is *CLINTON F. HEGG*, who has been assistant to the general manager of industrial sales.....*HAYS CORP.*, Michigan City, Ind., has named *ORVAL M. RIGGS*, manager of application engineering.

The new director of purchases for *WAGNER ELECTRIC CORP.*, St. Louis, is *J. S. SMITH*, who has been with the company 32 years, most recently as manager of the industrial sales department. Mr. Smith has established six buyer groups to expedite ordering and delivery. They are under the supervision of *H. S. GARRETT* and *E. V. ZIMMERMAN*.

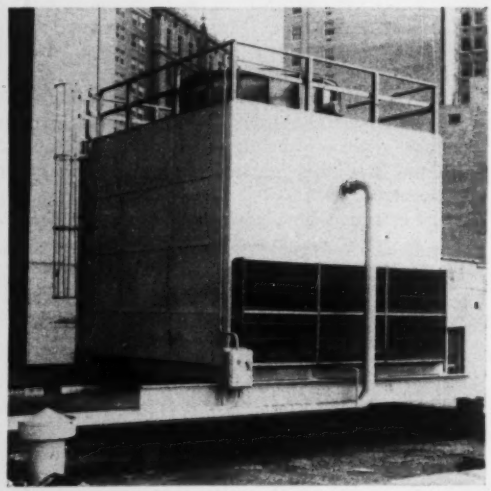
A. WILSON KNECHT, mechanical engineer, has been admitted to the firm of Seelye, Stevenson & Value, New York, N.Y., which will now be known as *SEELYE, STEVENSON, VALUE & KNECHT*, consulting engineers. For the past four years, Mr. Knecht has been chief mechanical engineer and assistant chief engineer for Walter Kidde Constructors, Inc.

Special field assignments for the handling of manufacturing accounts have been created in the heating controls sales division of *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis. *THOMAS A. REED* will handle accounts in the Hartford, Conn., area; *ROBERT R. MOORE* will contact manufacturers in and near Columbus, Dayton, Cincinnati, and Pittsburgh; and *GEORGE KELLER*, formerly district manager at South Bend, is now account executive in the Indianapolis and Louisville areas. *JAMES R. MAXIM* succeeds Mr. Keller in South Bend.

ROBERT T. EAKIN, who joined *ALLEGHENY LUDLUM STEEL CORP.*, Pittsburgh, as a student trainee in 1940, is now managing the Brackenridge, Pa., plant, succeeding *GEORGE EVANS*, who has become special con-

UNITED Builds A COMPLETE LINE OF COOLING TOWERS

for Refrigeration and Air Conditioning



450 ton United Tower in commercial air conditioning service. Transite sheathed; deck filled; low pressure sprinkler distribution.

Individually designed and constructed mechanical draft equipment in any required capacity.

Standardized, prefabricated, easily assembled "package" type spray towers for 5 to 30 tons refrigeration.

Bulletin No. 50 shows typical United installations in all fields . . . power, oil, gas and refrigeration . . . gives full details of design and construction features. Write for it today.

UNITED COOLING TOWER COMPANY

Porter Bldg. — Authorized Representatives in Principal Cities — Kansas City 2, Missouri

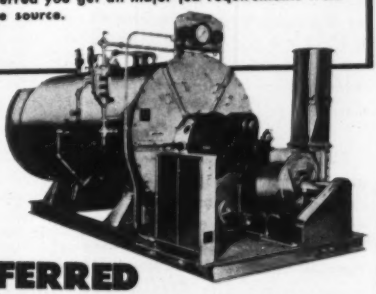
ONLY PREFERRED Offers Lowest Installation Costs

That's right! To install a Preferred Horizontal Rotary Oil Burner costs less than any other industrial oil burner. Exclusive and patented features cut time and labor needed for wiring, brickwork and piping. For example, all basic burner components are completely wired to the terminal junction box. Preferred has been able to lower installation costs because of their years of experience as a dealer, installer and distributor of oil burners. And they have put this practical experience to work for you.

Originally designed to meet the exacting requirements of the Preferred Unit Steam Generator, its fully automatic operation with residual fuels proved so successful that it has won wide acceptance for conversion applications.

It is available with associated Preferred products such as enclosed, pre-wired, union approved panels as well as pump and heater sets where applicable.

At Preferred you get all major job requirements from a single source.



PREFERRED Unit Steam Generator

The Preferred Unit Steam Generator is a custom-built boiler designed to maintain its guaranteed efficiency for a quarter of a century with a minimum of maintenance. It is the result of 28 years of combustion experience combined with the latest technical advances in pressure vessel design. That is why the Preferred unit offers the lowest installation cost, greatest economy and longest life of any steam generator.

Write for Burner Bulletin 175, Generator Bulletin 1000 and material cost estimates on your application. PR-201

PREFERRED UTILITIES MANUFACTURING CORPORATION
186C BROADWAY, NEW YORK 23, N. Y.

with a GREENLEE HYDRAULIC BENDER

Yes, make pipe bends "right on the job" . . . exactly where and when you need them! And do the job swiftly, accurately with a GREENLEE Hydraulic Pipe Bender.

Bends pipe up to 4½". Simple to operate, easy to carry, set up and shift from job to job. With a GREENLEE *one man* makes smooth, precise, uniform bends in but a few minutes. Speeds your piping installations, cuts costs on labor and materials. In timesavings alone, the GREENLEE pays for itself quickly.

Ideal for radiant heating jobs, too. For complete details write for free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2345 Twelfth Street, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

For Measuring...

AIR VELOCITY

THE *HASTINGS* AIR-METER

SO SMALL IT FITS IN THE PALM OF YOUR HAND*

IDEAL FOR:

- Laboratories
- Schools
- Air Conditioning
- Heating
- Inspection Work
- Gas Flowmeter
- Anywhere air or gas velocities are to be measured

The HASTINGS AIR-METER is ideal for measurement of air and gas velocities from a low of 5 feet per minute up to 6,000 feet per minute. The instrument's unique principle of operation eliminates the effect of temperature and rate of temperature change. It is not affected by normal atmospheric pressure changes. A compact unit that weighs only 24 ounces. May be operated from a 110 V, 60 cycle a-c outlet or from a battery pack.

*Adaptable to standard extension cords

ALSO THE HASTINGS PRECISION AIR-METER

Developed for field or laboratory use where extreme sensitivity and stability are required. Operates on same principle as standard Air-Meter. Easily adapted for use as a flowmeter or with remote recording or indicating instruments. Reading indicator lag is less than one second. Other special probes available. WRITE TODAY for complete data on both Air-Meters.

HASTINGS INSTRUMENT COMPANY, INC.

HAMPTON 7, VIRGINIA

DESIGNERS AND BUILDERS OF RAYDIST AND SPECIAL ELECTRONIC, ELECTRICAL, AND MECHANICAL INSTRUMENTS

sultant to the vice president in charge of operations. Mr. Eakin won the company's achievement award for his work at the carbide alloys plant, Ferndale, Mich., and has been assistant plant manager at the Brackenridge plant since 1950. Mr. Evans, with the firm for 42 years, will retire this year.

FRED H. ANGIER is now district manager for the Philadelphia and Baltimore factory branch offices of *GENERAL CONTROLS CO.*, Glendale, Calif. From Philadelphia, he will direct operations in a number of states and the District of Columbia. Succeeding him as manager of the Baltimore factory branch office is *J. B. CRANDLEY*, formerly sales engineer in the Philadelphia office.

EMERSON ELECTRIC MFG. CO., St. Louis, has elected three new vice presidents: *H. C. MILLER*, formerly works manager, who is now general works manager; *R. E. OTTO*, who also retains his post as general sales manager; and *R. E. PETERING*, who is now assistant treasurer and who had been comptroller and assistant secretary-treasurer. *B. W. JACKSON* has been elected comptroller and assistant secretary.

New Emerson appointments include *J. A. ALLES*, previously director of purchases, who is now director of purchases, armament division; *L. A. DAHLHEIMER*, former purchasing agent and now director of purchases, electrical division; *R. E. KNOWLES*, who moves from assistant works manager to works manager, armaments division; and *F. G. SACHLEBEN*, formerly assistant works manager and now works manager, electrical division.

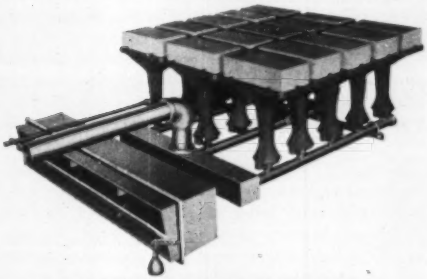
C. H. SCHOFIELD is now service manager of the heating department of *DRAVO CORP.*, Pittsburgh, replacing *M. H. STERN* who has been assigned as sales engineer for Michigan, with headquarters in Detroit. *DANIEL F. MAGNER* is a new sales engineer covering the Washington, D. C., area for the heating department of the machinery division. Formerly he was with an export associate of the company, Lynch-Wilde & Co.

GEORGE PAYTON has been appointed southeastern district manager for *UNISTRUT PRODUCTS CO.*, Chicago. A new branch office and warehouse serving this district has been established at 188 Hunter St., S.E., Atlanta. . . . . *ELMER J. BOER*, who has been with Battelle Memorial Institute until recently, is now development engineer with *BITUMINOUS COAL RESEARCH, INC.*, Pittsburgh. He will do research in the field of heat and power generation.

DAVID A. NURSE has joined the staff of *ROBERT B. HOLLAND CO.*, Los Angeles, West Coast representative for *KRAMER TRENTON CO.*, Trenton, N. J. He will direct sales activities at the branch office in San Francisco. . . . *L. E. PELLETIER*, Newton, Conn., is now sales engineer in that state for *C. A. DUNHAM CO.*, Chicago. He will supervise installation and servicing of heating systems and will advise on the application of the firm's heating products.

WEBSTER
SERIES F 600 BURNER

For Low Pressure Gas



Designed for LOW GAS PRESSURE
INTERCHANGEABLE PORTS
RADIANT fire brick top
NO COMBUSTION CHAMBER required
Will NOT VIBRATE
LOW draft loss
ANY SHAPE and SIZE
INTEGRALLY MOUNTED pilots

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WEBSTER
KINETIC* BURNER

For Low Pressure Gas

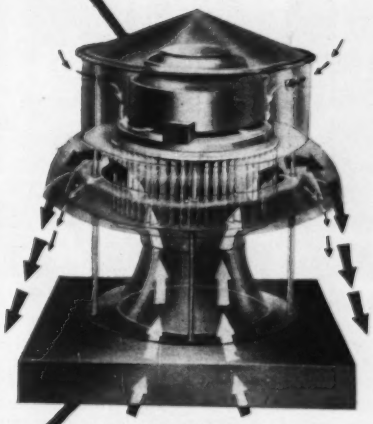
The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

3 VITAL GALLAHER FEATURES



Pat 2188741 2526290 ®
AIR-VANS feature

1 CERTIFIED RATINGS

Gallaher performance data is the result of independent laboratory tests under the direction of a nationally recognized authority. They *are not* theoretical calculations which are often grossly inaccurate.

2 SAFE FUME HANDLING

Air-Vans are designed with motor out of the airstream to safely handle contaminates. Fresh clean air is constantly drawn thru the motor hood, creating a *positive air seal-off* around the motor shaft which absolutely prevents the passage of fume into the motor housing while unit is in operation.

3 SCROLL EFFECT

Gallaher research shows conclusively that you cannot achieve maximum efficiency beyond ½" static pressure with a centrifugal roof exhauster *without Scroll effect.* Air-Van is the only roof exhauster with this feature.

These features together with many others—economy of installation and maintenance, rugged construction, weatherproof and architecturally sound design make the Air-Van outstanding.

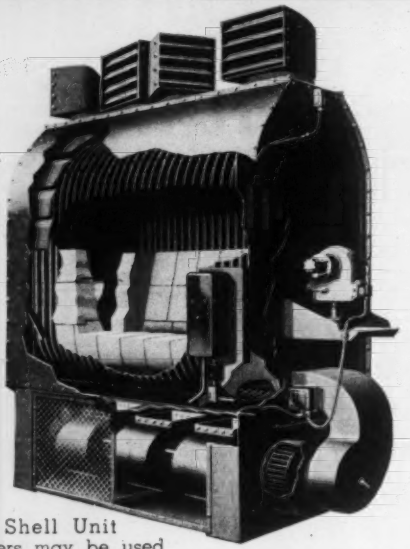
CAPACITY 150-12,000 CFM; Static Pressures to 1¾"

Gallaher Air-Vans are available for immediate delivery.

For full information, catalog and prices, see your local Gallaher representative or write Dept. H, 4108 Dodge St., Omaha.

The GALLAHER Company
Omaha, Nebr. Owatonna, Minn.

LEE SHELL UNIT HEATER



Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.
The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The LEE line . . .
Steel Encased Tubular Heater
Tubular Unit Heater
Brick-Set Tubular Heater
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Write now for more information

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WILMINGTON, DELAWARE

NEW BOOKS & REPORTS

Industrial Ventilation Manual Covers Recommended Practices

In industry, health hazards as manifested by dusts, fumes, vapors, gases and mists arising into the atmophere from the processing of industrial materials bring into sharp focus the importance of good ventilation practices. Cleanliness of air, however, has only recently received adequate attention despite the fact that the average worker daily "consumes" more air at work than the total weight of food and water. Comfort of workers is equally important. While the relation of temperature extremes to health may not be as well understood as in the case of contaminants, the need for comfort conditions is recognized.

Industrial Ventilation—A Manual of Recommended Practice has been prepared by the American Conference of Governmental Industrial Hygienists to meet the needs of official hygiene agencies for a ready single source of the most recent data on industrial exhaust ventilation, for standardizing ventilation practices and for training new engineers in the ventilation phase of industrial hygiene engineering. However, the manual should be a useful guide to plant engineers, ventilation contractors, and all others interested in the control of atmospheric contaminants in industry and in the comfort of workers.

Leading off with an explanation of the general principles of ventilation, the book covers dilution air volumes for various vapors; thermal standards, design factors, air sterilization, and estimation of radiant heat in connection with comfort ventilation; hood designs; duct design for both the balanced system and blast gate method; makeup and recirculated air; the various steps in testing ventilation systems; the selection, inspection, and maintenance of fans; and the principles, inspection and maintenance of air cleaning devices. In the chapter on hood design, information is given on the principles of design, the range of capture velocities for specific operations and data on 60 specific hood designs.

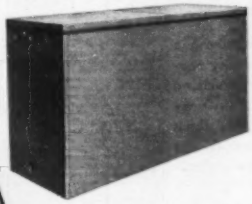
Of particular interest is the appendix which includes tabulated data on maximum allowable concentration values for continuous 8 hr exposure to numerous gases, vapors, dusts, fumes, and mists. A comparison chart gives information on comfort limits as well as maximum allowable concentrations for hydrocarbons, alcohols, ketones, esters, ethers, and miscellaneous solvents. Also included are tabulated data on the physical constants of various liquids, gases, and solids. Other useful data include solvent drying time and properties of typical commercial gases.

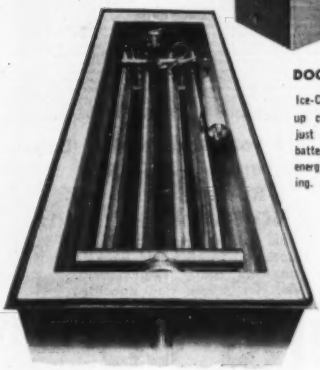
It is the intent of the committee that the available data will be reviewed from year to year, to make changes where indicated, and to maintain a practical up-to-date manual. This 162 page booklet has, therefore, been prepared in looseleaf form and is reproduced by the photo offset method. Copies may be obtained from K. M. Morse, Illinois State Health Dept., 1800 W. Fillmore St., Chicago 12, for $3.00. Members of the American Conference of Governmental Industrial Hygienists may obtain copies for $2.00.

New DOLE *Ice-Cels*

GOOD NEWS FOR AIR CONDITIONING

3 NEW UNITS





DOC DOLECO says —

Ice-Cel units store up cooling effect just as your car battery stores up energy for starting.

Ice-Cel

"Storage battery of refrigeration"

IMPORTANT SAVINGS OFFERED

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For years air conditioning firms have specified and installed DOLE Ice-Cels for chilled water cooling for peak loads of short duration — a few hours a day. They have proved to their complete satisfaction that Ice-Cel units save both on initial investment and on operating costs. In many cases Ice-Cel units may require **no** additional compressor because the unit can be charged at night when the machine is otherwise idle.

Now — DOLE has improved Ice-Cel performance even more. 3 new models, each with its own definite capacity range and all with new and improved design, are ready for your important air conditioning jobs. If you have used DOLE Ice-Cel units, you'll like their improved performance. If you don't know the advantages of Ice-Cel units, write today for complete information and prices.

DOLE manufacturing facilities including modern machinery and experienced personnel for sheet metal working are available for handling Government orders. We invite your inquiries.

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TO KEEP PACE WITH THE LOAD—ALL THE WAY!

No storage tank is necessary—they have enough, and more, heating surface built into them to heat the water as fast as it is drawn! Thousands in use.

If you have such a problem, we have the answer! Stock designs permit quick deliveries...at prices lower than you think!

Write today for a copy of our new Bulletin 70 Section I, describing this line of Paracoil Water Heaters.

This bulletin, in addition to tables of capacities and physical dimensions on our U-Tube designs, contains a wealth of practical, worthwhile engineering data on how to size, figure steam requirements, and pipe up PARACOIL INSTANTANEOUS WATER HEATERS. YOUR COPY AWAITS YOU!

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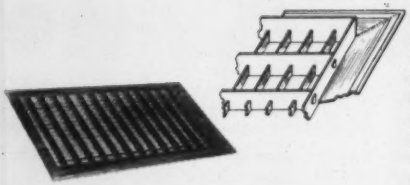

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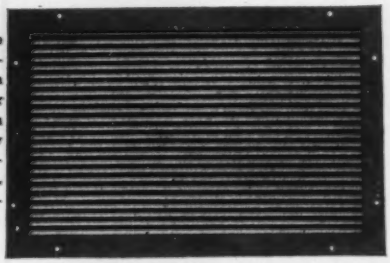
Look at the close mesh return air face. Also cross section showing precision corner construction. Bars are locked into frame for extra sturdiness. Available in many finishes including the popular golden oak grain made by actual transfer from genuine oak.

A-J Grilles are made of fine quality materials by precision workmen. On your job, you'll find them easy to install, low in cost and available in many sizes, patterns, and finishes.



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THE NO-SITE NO-LITE GRILLE

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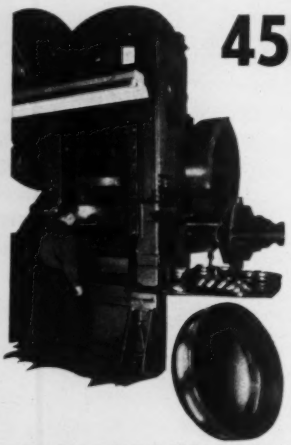

The tremendous facilities required for manufacturing AUTORAD Finned Radiation are more than ample for all reasonable trade requirements. Production facilities are available as well for the prompt and experienced handling of Government orders.

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30 years of experience in the design and manufacture of heat transfer equipment, and in manufacturing know-how, are back of AUTORAD Finned Radiation. For over a quarter of a century AUTORAD has paced the industry in improvements in engineering and production of heat transfer products such as finned coils, finned pipe, condensers, receivers and evaporators.

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AUTO-RAD Inc.

Manufacturers of Heat Transfer Equipment Since 1920

3535 Fillmore St., Chicago 24, Ill.

Re-Use of Industrial Water Essential

With water usage in this country double what it was a decade ago, selection of economical water cooling equipment necessary for the industrial re-use of water has become of vital importance, especially as power demands increase and industries expand their water needs. Speaking at the recent spring meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, H. E. Degler, technical director, Marley Co., Inc., continued by saying that water shortage has nothing to do with drought but can be attributed to over-population in cities and increased industrial and agricultural requirements.

This country's requirements, he said, are 100 billion gal per day for everything from drinking and irrigation to making steel and watering the lawn; that is 700 gal per day per person, he declared. Industrial requirements were said to be frequently in excess of 300 lb of water per pound of finished product. Power plants, manufacturers of paper, petroleum products, rayon, linen, textiles, lactose, sugar, explosives, hydrogen, rubber, and steel were named as large industrial users.

Mr. Degler pointed out that once-through use of cooling water in industry is wasteful, and stated that in many applications the same water can be used for additional service or continuous re-use. He outlined the principles of evaporative cooling and described the operation of mechanical draft cooling towers and air-cooled finned tube exchangers.

Refrigeration Standards Cover Marine Use, Expansion Valves

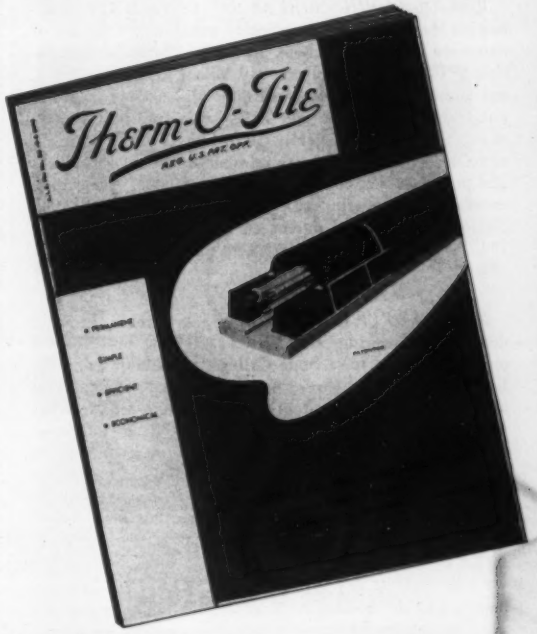
Two new standards have been approved by the American Standards Association. One is the American Standard Recommended Practice for Mechanical Refrigeration Installations on Shipboard, B59.1-1950, and the other is the American Standard Method of Rating and Testing Refrigerant Expansion Valves, B60.1-1950.

The shipboard standard is a guide for the design, construction, installation, operation, testing, and inspection of mechanical refrigeration equipment for the extraction of heat aboard merchant vessels. The various types of systems include those for cooling or dehumidifying air for circulation to or within ship compartments. Recommendations cover machinery, prime movers, pressure vessels, heat exchange apparatus, piping, valves, fittings, etc.

The standard on expansion valves covers methods of rating and testing thermostatic and constant pressure expansion valves for use in refrigerant systems employing volatile refrigerants. It specifies the equipment and procedure to be used in testing and rating, and lists the types of data to be recorded.

A committee of the American Society of Refrigerating Engineers developed these standards which will be revised by sectional committees on each of these subjects, organized under the procedures of the ASA. The ASRE will be the sponsor for these committees. Copies of the shipboard standard are priced at $1.00 each. Those of the expansion valve standard are 50 cents each. Both standards may be obtained from ASA headquarters, 70 E. 45th St., New York 17, or ASRE headquarters, 40 W. 40th St., New York City.

Just Published!



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This up-to-the minute publication on Underground Pipe Conduits should be at the finger tips of every heating engineer, contractor, or user of underground conduits. The coupon below will make it easy if you haven't time to write a letter. If you have an underground pipe conveying problem, Porter-Hayden Engineers and Contractors will gladly cooperate with you.

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Other Books and Reports Received

BIBLIOGRAPHIC SURVEY OF CORROSION—Continuing the service of periodically publishing abstracts of corrosion literature in book form, the National Association of Corrosion Engineers, 919 Milam Bldg., Houston 2, has prepared a volume containing abstracts of material published during 1946 and 1947. Containing over 3000 abstracts arranged topically according to the NACE abstract filing index and cross referenced, the book contains 288 pages, is clothbound, is priced at $9.00. Association members may obtain copies for $7.00. The 1946-1947 bibliography may be purchased in combination with the 1945 bibliography at $9.00 to members, and $12.00 to others.

REPORT PREPARATION, by Frank Kerekes, assistant dean of engineering, and Robley Winfrey, professor of civil enginering, Iowa State College. Available from the Iowa State College Press, Ames, Ia., for $6.90 this 450 page book was prepared primarily to train engineers in writing scientific papers and reports. Some 26 industrial firms throughout the country are cited for excellence in their business correspondence. The authors estimate that they have trained some 3000 engineers in report preparation during the 30 years that the course has been taught at the college.

SYMPOSIUM ON ULTRASONIC TESTING—The 10 papers and discussions included in this book represent a summary of the history, theoretical aspects, basic principles of practical testing, and practical applications for the ultrasonic testing of materials, as presented at sessions on the subject sponsored by ASTM Committee E-7 on nondestructive testing and at recent annual meetings of the American Society for Testing Materials. Copies of this 140 page paper covered book, identified as Special Technical Publication No. 101, may be obtained from ASTM headquarters, 1916 Race St., Philadelphia 3, for $2.00.

U.S. ATOMIC ENERGY COMMISSION CONTRACTING AND PURCHASING OFFICES AND TYPES OF COMMODITIES PURCHASED—First published in October 1949, this booklet has been revised and is designed to assist businessmen interested in selling products to the AEC and its contractors. It was prepared particularly for the guidance of small business concerns and is said to answer the questions, What is bought for the AEC? Who buys it? Where are the procurement offices located? It contains lists of the commodities purchased by or for the commission and its contractors, the addresses of purchasing offices and agents, and instructions on how a business firm may qualify to receive invitations to bid. The AEC has also recently brought up to date the listing of its operations offices and key personnel as included in the publication, A Guide for Contracting of Construction and Related Engineering Services. This booklet describes the contracting policies of the AEC for construction work and architectural and engineering services. Both books are priced at 15 cents, and are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

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And—*the reason* is so obvious—it's the *hair* that cleans the air, so easily, so effectively, so economically. Mother Nature knew the answer, when she placed Hair (the ideal air filtering medium) in the nostrils of all mankind, as an essential part of the human air-filtering system.

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OF ALL TYPES AND SIZES

SKIDMORE Pumps are engineered to give you the maximum Pump Performance under all types of conditions and installation requirements . . . to save you money in operation and maintenance costs. Skidmore's Engineering Staff is always ready to advise you as to the correct heating pump to meet your requirements. Remember, when you specify a Skidmore Pump you gain custom-built performance at a production price.

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3. TYPE "TM" HIGH PRESSURE TURBINE PUMP is designed for pressures up to 150 pounds, and boilers to 250 H. P. See Bulletin No. 17.

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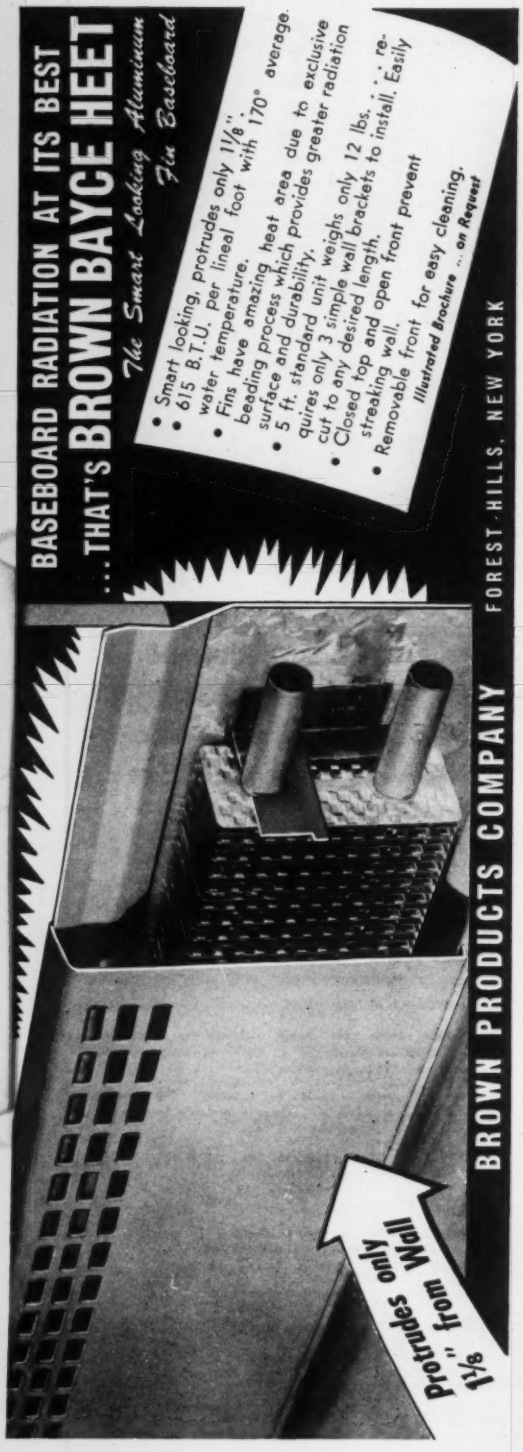
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MEETINGS & CONVENTIONS

HEATING, PIPING & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, 1250 Avenue of the Americas, New York 20—The 62nd annual convention, Shoreham hotel, Washington, D. C., May 8 to 11.

AMERICAN INSTITUTE OF ARCHITECTS, Washington 6, D. C.—The 1951 convention and national seminar meetings will be held May 8 to 11. Edgewater Beach hotel, Chicago. For the first time in 83 years a product exhibition will be held in conjunction with the affair. According to the institute, only those building products or methods recently placed in production or shortly to be offered commercially will be granted space.

HEATING, REFRIGERATION CONTROL SHOW—A new series of educational control shows, offered by Penn Electric Switch Co. as a service to heating and refrigeration engineers and servicemen, began last month and is traveling throughout the southern and southeastern states. It was created to demonstrate the use, construction, installation, and servicing of automatic controls. This month, the show will be held in Macon, Jacksonville, Savannah, Charleston, Columbia, Raleigh, and Greensboro. It will be held next month in Charlotte, Asheville, Knoxville, Chattanooga, Nashville, and Louisville.

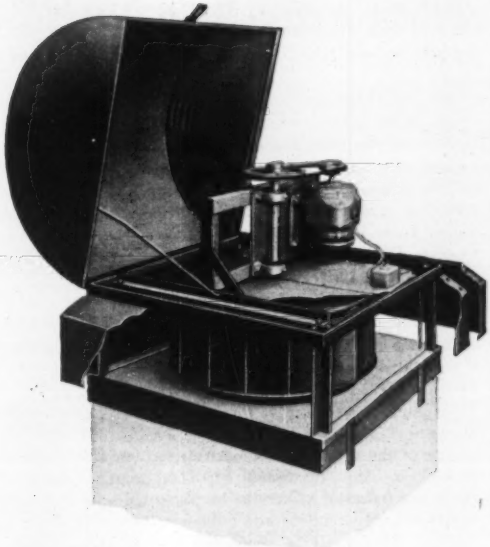
IBR SCHOOL OF MODERN HEATING, sponsored by the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.—This is a traveling school designed to provide an intensive three-day training in heating design and installation. Classes will be held this month in Cincinnati, Columbus, Ohio, and Cleveland. Classes will be held next month in Pittsburgh, Detroit, Buffalo, Syracuse, Albany, and Elmira, N. Y. Additional information may be obtained from the institute.

ENGINEERING INDUSTRIES EXHIBITION—To be held in conjunction with the silver anniversary convention of the New York State Society of Professional Engineers, May 10 to 12, Hotel Statler, New York City. Additional information may be obtained from the chairman of the society's exposition committee, 1941 Grand Central Terminal, New York 17.

NATIONAL ASSOCIATION OF BUILDING OWNERS AND MANAGERS, 134 S. La Salle St., Chicago—The 44th annual convention will be held May 20 to 24, Houston, Tex.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—The 38th spring meeting will be held at the Hotel Statler, Detroit, May 27 to 30.

Some of the technical papers scheduled will deal with designing small air conditioning systems to maintain comfort during mild and humid weather, low temperature refrigeration application, solubility of air in "Freon" refrigerants, reflective insulation, greenhouse air conditioning, and muli-cylinder ammonia compressors.



Effective *quiet* duct exhaust with Swartwout **Airlift**

Centrifugal Fan Type Ventilator

Here's measurable *effective* exhaust capacity at very low noise levels! Quietness alone in duct exhausters won't fill the bill if you fail to get the capacity needed for the job without wasteful size and cost. Swartwout Airlift is powered by an unusually efficient centrifugal fan wheel that has *certified ratings*. And Airlift ventilator design adds effectiveness with streamlined fan inlet and oversize outlet opening. Turbulence and friction losses are cut to the minimum. 14 sizes in a wide variety of capacities.

Airlift brings you the quiet ventilation wanted in industrial offices, laboratories, dispensaries, recreation rooms — and in schools, apartments and commercial buildings. Write for Bulletin 341F.

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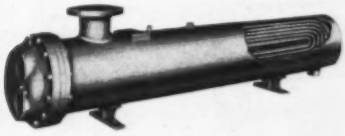
IMMEDIATELY AVAILABLE FROM STOCK . . . WHITLOCK STEEL SHELL STORAGE HEATERS AND INSTANTANEOUS HEATERS

These popular sizes of Whitlock storage and instantaneous heaters are in stock at Hartford . . . ready for immediate shipment to serve your needs. You get two big savings when you choose a stock Whitlock heater: (1) immediate availability saves you time (2) quantity production in our plant saves you money. Select your heaters from this group . . . take advantage of these savings.

WHITLOCK STEEL SHELL STOCK TYPE K STORAGE HEATERS

Shell Size	Shell and Head Thicknesses	Storage Capacity	*Heating Capacity
30" x 96"	1/4" x 3/8"	280 gal.	500 GPH
36" x 120"	1/4" x 3/8"	500 gal.	800 GPH
42" x 120"	5/16" x 1/2"	680 gal.	1250 GPH
48" x 120"	5/16" x 1/2"	870 gal.	1500 GPH

*40 to 180°F with steam at atmospheric pressure
Construction and stamping in accordance with ASME Code



WHITLOCK STOCK TYPE R INSTANTANEOUS HEATERS

Size	Overall Dimensions	Sample Ratings (GPH) Heating 40 to 180°F Steam Pressure 5#	25#	100#
6-B-60	10 1/2" x 65"	425	1010	——
6-B-84	10 1/2" x 89 5/8"	950	——	2260
8-B-72	12 1/2" x 78"	1300	2840	3240
8-B-96	12 1/2" x 103"	2470	——	5875

Available in 2 and 4 pass constructions
Construction and stamping in accordance with ASME Code

Contact your nearest Whitlock office or representative or write us at Hartford for Bulletins 40A and 46 covering Whitlock Type K Storage Heaters and Bulletins 20A and 23 covering Whitlock Instantaneous Heaters.

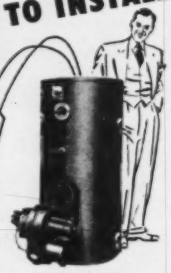
The Whitlock Manufacturing Co.
44 South St., Hartford 10, Conn.

New York • Boston • Chicago • Philadelphia • Detroit • Richmond
Authorized Representatives in Other Principal Cities
In Canada: Darling Brothers, Ltd., Montreal

WHITLOCK HEATERS

Easier TO BUY TO SELL TO INSTALL

ALDRICH Packaged BOILER-BURNERS



Here are compact, complete, packaged boiler-burner units in sizes for home and industry, for low-pressure steam and hot water heating and/or hot water supply. All are oil-gas interchangeable. They're economical to buy and use, easy to install in minimum space with a minimum of skilled labor. Write for information.

UNIQUE NEW "BANTAM," rated at 100,000 BTU per hour is especially designed and priced for modern low-cost homes. 45 in. high; occupies 20x33 in. floor space. Provides heat and domestic hot water in excess of FHA requirements.

SERIES "B" Heat-Pak Units give dependable, efficient performance on all types of steam or hot water heating systems. Six sizes 118,000 to 808,000 BTU. Ideal for residences, commercial and industrial establishments. All Aldrich Boiler Burners also available for hot water supply only.

ALDRICH

ALDRICH COMPANY

105 East Wilkins St., Wyoming, Ill

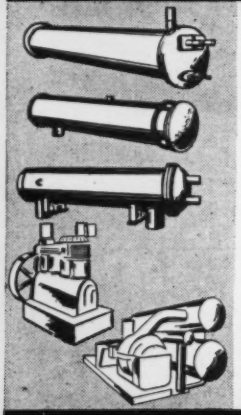
Subsidiary of Breeze Corporations, Inc.

ALDRICH HEAT-PAK PRODUCTS

JOBBERS: You'll make more money with Aldrich—write for facts about Aldrich Boiler Burner Units and Aldrich precision built oil burners; models from .75 to 19 GPH. **DEALERS:** Write for name of nearest jobber.

ANOTHER BREEZE CORP. PRODUCT

QUICK - PROMPT RETUBING SERVICE



on
FREON - AMMONIA - CO_2 CONDENSERS AND COOLERS —ANY CAPACITY. STEAM CONDENSERS

BOILERS HEAT EXCHANGERS OR ANYTHING WITH TUBES

Reconditioning and Overhauling Centrifugal and Reciprocating Pumps Centrifugal and Reciprocating Refrigerating Compressors Large Stock Tubes on Hand

THE MAINTENANCE DEPARTMENT of CONDENSER SERVICE & ENGINEERING CO.

Phones: New York, REctor 2-9363; Hoboken, HOboken 3-4428

100 River Street Hoboken, N. J.

For New Equipment - Write our general office
95 River St., Hoboken, N. J.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6—The 42nd annual meeting will be held June 5 to 8 at the Statler hotel, Detroit.

IBR HEATING SHORT COURSE—The annual short course in hot water and steam heating, of the Institute of Boiler and Radiator Manufacturers, will be held at the University of Illinois, Urbana, Ill., June 12 to 15. There will be two courses, one for beginning and another for advanced students. Additional information may be obtained from R. K. Newton, supervisor, engineering extension, Division of University Extension, Room 205, Arcade Bldg., University of Illinois.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia—This year's annual meeting is scheduled for June 18 to 22 at Chalfonte-Haddon Hall, Atlantic City.

An important feature of the program will be the Edgar Marburg Lecture to be given by Frank L. LaQue, in charge of the corrosion engineering section, International Nickel Co. He will discuss corrosion testing. Some of the many technical papers to be presented will deal with coal sampling problems and both ferrous and nonferrous metals. There will be seven technical symposiums, including one on acoustical materials.

STOKER MANUFACTURERS ASSOCIATION, 307 N. Michigan Ave., Chicago 1—The annual meeting will be held at the South Shore Inn, Lake Wawasee, Syracuse, Indiana, on June 25 and 26.

EIGHTH INTERNATIONAL CONGRESS OF REFRIGERATION—To be held in London, England, August 29 to September 11. Additional information may be obtained from the secretary of the conference, Dalmeny House, Monument St., London, E. C. 3.

6th NATIONAL INSTRUMENT CONFERENCE AND EXHIBIT—Sponsored by the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12. The affair will be held in the Sam Houston Coliseum, Houston, Tex., September 10 to 14.

INTERNATIONAL DISCUSSION OF HEAT TRANSFER—Postwar heat transfer developments will be the theme of a meeting, September 11 to 13, London, England. Plans for participation by engineers in the western hemisphere are being arranged by a joint committee on North American participation, which consists of representatives from some 12 professional and engineering societies. The American Society of Mechanical Engineers is coordinating administrative details.

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 E. 60th St., Chicago 37—The Public Works Congress and Equipment Show will be held September 16 to 19 in the new Veterans Memorial Bldg., Detroit.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 919 Milam Bldg., Houston 2, Tex.—The annual meeting of the association's South Central Region is scheduled for October 18 to 20, Corpus Christi, Tex.

Sterlco Heating and Temperature Control Products

Heating Specialties

¾" 69-B Float and Thermostatic Trap.

Thermostatic Traps: ½" to 1" sizes; low, medium, high pressure; wide variety of body styles.

Float and Thermostatic Traps: ¾" to 2" sizes; low and high pressure.

Strainers: ⅜" to 2" sizes; cast iron or brass bodies. Also *Radiator Valves, Vents, Boiler Return Traps.*

Temperature Control Valves

120-A Thermotrol Individual Radiator Temperature Control.

No. 120 Thermotrol: Self-contained individual radiator temperature control for steam or hot water. Easily installed in place of manual radiator valve. Sizes ½" to 1"; all body styles.

Tank Temperature Controls: Self-powered modulating control valves for fluid heaters and all types of process equipment for heating or cooling. Sizes ⅜" to 2".

Condensation and Vacuum Pumps

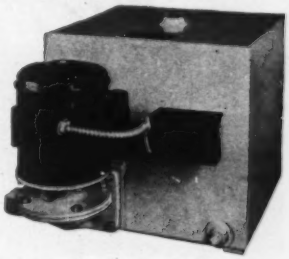
4100 Series: Compact, economical condensation pumps with 15 or 30 gallon steel tank, dual voltage capacitor type motor, rotary seal, and simple, sturdy vertical centrifugal pump. For all low pressure jobs up to 14,000 sq. ft. E.D.R. and 20 lbs. pressure.

4200 Series: Same as 4100 Series except cast iron tanks.

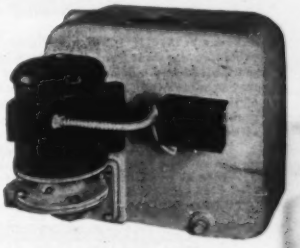
3500 Series: Heavy duty condensation pumps with pedestal mounted steel tank, for a wide range of jobs — 2000 to 65,000 sq. ft., up to 150 lbs. pressure.

3700 Series: Condensation pumps with heavy cast iron tank for installation underground or in wet locations, 2,000 to 20,000 sq. ft., 20 or 30 lbs. pressure.

Vacuum Pumps: Type V, 2500 and 5000 sq. ft., 20 lbs. pressure. Type S, 10,000 to 40,000 sq. ft., 20 to 40 lbs. pressure.



4126-B Condensation Pump (Steel Tank)



4226-B Condensation Pump (Cast Iron Tank)

Descriptive bulletins with complete specifications of any of the above products will be furnished promptly upon request.

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Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the pumps, valves, traps, compressors, specialties of all kinds, etc., you need — and where they're located. They're indentified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference.

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"Your directory stays in this office until the next January issue comes along. Numerous times we refer to it."
FORT WAYNE CONTRACTOR

"In our work, we make use of your Directory time and time again. Our reference file would not be complete without it."
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...keeps **Western Rotary Turbine Ventilators** in operation, providing constant 'round-the-clock exhaust. Western's lifetime-guaranteed bearings are both mounted on the same axis...always stay in alignment...stand up to shipping jolts. Throat sizes from 6" through 48". The typical, clean, attractive silhouette that progressive industry demands. Western turbo-ventilation...high in efficiency, low in cost.

Request our catalogue for information, sizes, capacities, price lists. In 1951 Sweets and A.E.C. Jobbers are invited to participate in our national sales system.

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GENERAL G+C CONTROLS
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Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls
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DISTRIBUTORS IN PRINCIPAL CITIES

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 209. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Conditioning Guides

HPAC 101—Two nontechnical, 20 page air conditioning "planning guides" (Booklets B-5159 for commercial, and B-5160 for industrial use) are offered by Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36, Mass. Topics covered include the basic functions and construction of various types of conditioning units, and specific conditions under which the various types should be used.

Also available is a similar 8 page leaflet (Booklet SA-6691) which explains the operation, uses and proper selection of "Precipitron" electrostatic air cleaning equipment.

Air Filter Gages

HPAC 102—Ellison Draft Gage Co., 214 W. Kinzie St., Chicago 10, has prepared a bulletin on its gages for indicating air flow resistance through air filters. According to the manufacturer, the error of its inclined type gage does not exceed 0.02 in. at any point. Also described are dial gages.

Ammonia Condensers

HPAC 103—Bulletin 228-E of Frick Co., Waynesboro, Pa., stresses space economy and "balanced water flow" features of its type VS vertical shell and tube ammonia condensers. Construction data are given for the outside shell, water tubes, water reservoir, etc., and photographs show important components, such as the deflector ring and cast iron swirls which distribute condensing water against the inner wall of each tube.

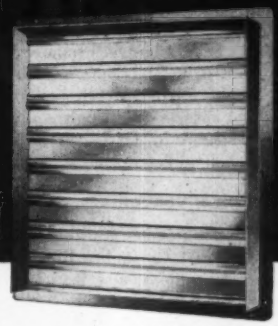
Boilers, Convectors, Unit Heaters

HPAC 104—National Radiator Co., Johnstown, Pa., has prepared a condensed 20 page general catalog (No. 586) giving design and construction features, ratings, capacities, and roughing-in dimensions of its cast iron and steel heating boilers, convectors, water heaters, unit heaters, and cast iron radiation for industrial, institutional and commercial use. Boilers are designed for use with oil, coal, gas or stoker firing, and unit heaters include both horizontal and downflow types.

Bronze and Iron Cocks, Valves

HPAC 105—A new eight page price list covering its iron and bronze valves and cocks, iron and brass unions, and expansion and swing joints has been issued by Jarecki Valve Div., H. K. Porter Co., Inc., Tulsa, Okla. Prices are also listed for valve repair parts and malleable cock wrenches. Briefly mentioned are construction features and recommended uses.

they all want AIR-FLO



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

FRONT VIEW—CLOSED

IT TAKES THE LOAD OFF THE FAN!

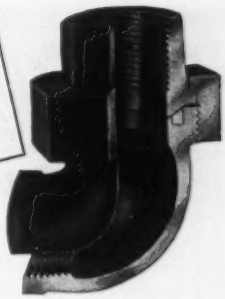
Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

WRITE FOR NEW AIR-FLO CATALOG 43-D

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

Simplify PIPING MAINTENANCE



Use Reliable
JEFFERSON UNIONS

Poor piping installations are eliminated when the joints are made with Jefferson Unions. We know you want the best that's why we make them from a very fine malleable iron having a tensile strength of 55,000 lbs per sq in . . . why we cut the brass rings from special tubing . . . why we air test them before shipping . . . why the ring channels are *machined* instead of cast. We are sure they will provide the answer to any and all piping problems.

Drop us a line today for more information.

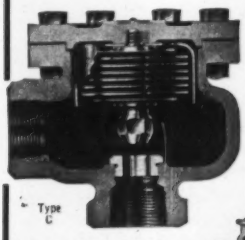
JEFFERSON UNION CO.
607 West 26th Street, New York 1, N. Y.
35 Fletcher Avenue, Lexington 73, Mass.
65 Gooding Street, Lockport, N. Y.

Nicholson Steam Traps

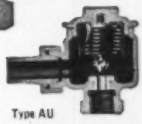
CUT HEAT-UP TIME 48%

A large processor recently reduced the heating cycles of cookers from 1¾ hrs. to 50-60 min., by substituting Nicholson thermostatic steam traps for a mechanical type. This effected a gratifying production increase of 37%. Reasons for Nicholson's faster heat transfer: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting.

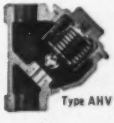
5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes, ¼" to 2"; press. to 225 lbs.



Type C



Type AU



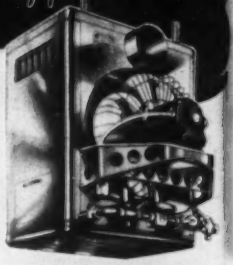
Type AHV

BULLETIN 450 or see Sweet's

W. H. NICHOLSON & CO. 198 OREGON ST. WILKES-BARRE, PA.

Sales and Engineering Offices in 53 Principal Cities

REZNOR
world's largest selling gas unit heater



YOUR Spring AND Fall HEATING IS CHEAPER WITH REZNOR

. . . that's the spring song your unit heater prospects appreciate now. Reznor gas units produce just enough heat for mild days and lots for the cold ones . . . and always, with a minimum of fuel. For small areas, sell single units—for factories, warehouses and stores, sell complete systems with multiple unit installations.

Hung from ceiling or mounted on floor

REZNOR MANUFACTURING CO.
31 UNION ST. • MERCER, PENNA.
Send me 20-page catalog in full color

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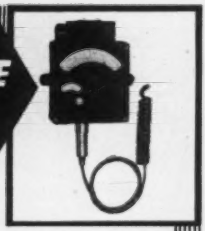
NEW TYPE CI



ADJUSTABLE THERMOSTAT

The new Type CI Adjustable Indicating Thermostat is a precise temperature control for gas, liquid, and metal-to-metal applications, such as ovens, hot plate presses, water baths, incubators, proofing cabinets and cold cabinets. It is most useful on units where periodic checks of temperature are required, advisable, or will prove time-saving. The new Type CI is simply and ruggedly built, employing the highly sensitive response action of a solidly liquid-filled bulb and bellows assembly to a snap-acting switch and indicating pointer. The thermostat is adjustable over its entire range by a knurled thumbscrew on the front of the case.

SPECIFICATIONS:
Case 3½ x 3½ x 1¾"; Wt. 3 lbs. Standard ranges 50° — 350°F and 50° — 600°F, special ranges may be had between —120°F and +600°F. Standard differentials ½°F in circulating liquid, 2°F in air. Switch ratings 10 amp 125 V AC and 5 amp 250 V AC. Write for new bulletin No. 4816T which gives full details.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street
Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

TWO WELL KNOWN FIRMS —

HAJOCA Corporation

C.A. DUNHAM Company

. . . combined to give you one great service

Hajoca Corporation takes pleasure in announcing it is now handling the complete Dunham line of top quality heating equipment including

Baseboard Radiation	Unit Heaters
Convector Radiation	Pumps
Fin-Vector Radiation	Traps and Valves

HAJOCA CORPORATION
General Offices: 31st & Walnut S s., Phila. 4, Pa.
33 Atlantic Seaboard Branches
(See Your Telephone Directory for Local Address)

HEATING SYSTEMS AND EQUIPMENT **DUNHAM**

Centrifugal Pumps

HPAC 106—Peerless Pump Div., Food Machinery Corp., 301 West Ave. 26, Los Angeles 31, has prepared a 24 page illustrated bulletin (B-2300) covering applications, construction, dimensions, and ratings of its horizontal end-suction centrifugal type "Fluidyne" pumps. These units, with capacities from 10 to 5500 gpm and designed for heads up to 260 ft, are offered in two basic types; model PE, a close-coupled electric driven unit, and model PB, a bracket mounted pump for use with a flexible coupling, v belt, or flat belt pulley.

Conditioners, Evaporative Condensers

HPAC 107—A new bulletin recently issued by Typhoon Air Conditioning Co. Inc., 794 Union St., Brooklyn 15, combines specifications, illustrations, and features of its packaged air conditioner models from 1½ to 20 tons, as well as data on evaporative condensers, offered in sizes from 3 to 20 tons. Specifications and ratings for each size are shown, as well as diagrams illustrating outside dimensions and general arrangements of components. "Deep-row" construction of cooling coils (5 rows for the five ton units) is stressed. Condensers have the same plan dimensions as their corresponding packaged conditioners so that they become a companion piece for a combined installation.

Diffuser for Water Heater

HPAC 108—A catalog sheet available from O'Brien Steam Specialty Co., Inc., 301 Heffernan Bldg., Syracuse 2, N. Y., illustrates and gives dimensions and features of a new all-bronze diffuser for use with the firm's steam mixer water heater and for use with open tank heating. Staggered holes in inner and outer shells break steam into small streams. The unit is available in 1 in. and 1½ in. IPS.

Direct Fired Air Heaters

HPAC 109—The Vol. 6, No. 2 issue of the house organ published by Dravo Corp., Neville Island, Pittsburgh 25, features an article on the use of its direct fired space heaters in a large west coast cold reduction heat and tinplate mill. The company's two new crane cab conditioners are briefly described and illustrated. Also included is a description of the installation of two high pressure boilers and waste heat boilers in a large steel plant.

Dust Collectors

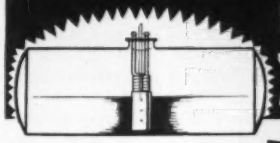
HPAC 110—The series 342 line of mechanical type dust precipitators for fly ash, cinders and industrial dust is described in Bulletin 1728, prepared by American Blower Corp., Detroit 32. Principles of operation are described, selection data, performance factors, and efficiency curves are given, together with assembly arrangements, dimensions, and physical data.

Electric Heating of Piping

HPAC 111—The "Thermal Electric" system is defined as a process of impressing low voltage current characteristics on the walls of pipe, using the fluid conveying pipe as an electrical conductor. By this means, heat is generated to offset the heat losses of pipes and to maintain initial fluid temperatures entering the piping systems. The

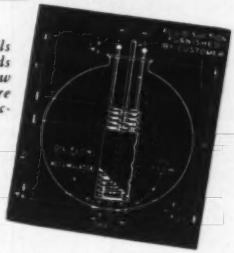
PREHEAT HEAVY OILS
IN STORAGE TANKS

REMPE
"Hot Spot"
PREHEATER



Write for details and price.

Preheats fuel oils and other liquids to proper flow temperature before entering the suction line.



No. 5 and Bunker C oils flow more freely at high temperatures — have greater BTU value.

The Rempe "Hot-Spot" does the preheating job efficiently. Takes the load off the suction pump.

All-steel construction. Inlet and outlet pipes furnished in required lengths for any diameter tank. Steam or Hot Water can be used as heat source. Made with 14" or 16" diameter shell.

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

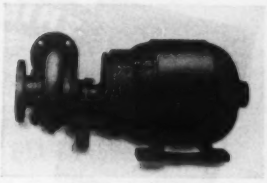


Fig. 3650 Close-Cupld Centrifugal

In Air Conditioning . . . The Right Pump Can Mean a Contented Customer

Satisfied customers are your best salesmen for air conditioning. When an installation operates smoothly—without breakdown or repair—you have fewer headaches and your customer's satisfaction builds new sales for you.

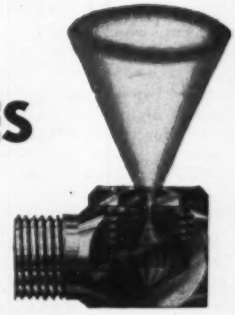
Using exactly the right pump for the job eliminates one source of trouble. Goulds has a wide selection of Close-Cupld pumps for air conditioning. These Goulds pumps are famous for long, carefree service—which is the kind of service that means satisfied customers—and new business! For larger jobs Goulds Double-Suction Centrifugals are equally dependable.

Call or write Pump Headquarters for complete information.

Goulds PUMPS INC.
Seneca Falls New York

Complete Line of

SPRAY NOZZLES



Whatever your spraying job, there is a Delavan nozzle designed to suit your particular needs.

Write now for

CATALOG NO. 30

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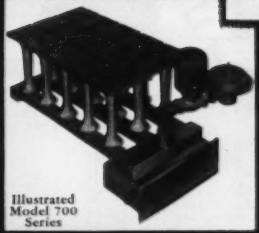

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For Commercial, Industrial and Domestic Installations

•Reinhard Burners are built for converting practically every type of furnace, stove or range.

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Get the EXACT spray nozzle type and size to fit your need.

WRITE for Catalog 22 . . . General Catalog
Catalog 23 . . . Pneumatic Atomizing Nozzle Catalog

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KEY COMPANY
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KEY Company

Vol. 2, No. 5 issue of the house organ published by Fluid Systems, Inc., 1881 Dixwell Ave., New Haven, Conn., defines the system, describes the variety of fluids which may be handled, gives information on operating costs and the engineering services available from the company. Applications and specifications which permit the handling of any hard-to-flow fluids through any length of pipe are given. The Vol. 2, No. 6 issue of the company house organ describes an application in connection with the automatic, intermittent delivery of liquid soap to automatic laundry machines. Suggested specifications for an installation of this type are given.

Evaporative Condensers

HPAC 112—A four page catalog (C-14.301) describing "Wat-R-Miser" series O evaporative condensers, is now available from Drayer-Hanson Inc., P.O. Box 2215, Terminal Annex, Los Angeles 54. Designed for small air conditioning and commercial refrigeration installations, and factory assembled as single units, they can be installed against outside walls (eliminating the need for ductwork). They are available in four sizes.

Evaporative Roof Cooler

HPAC 113—Siegfried Ruppright, Box 6795, Los Angeles 22, has released a folder on a rotary roof cooler designed for use on factories and other large buildings. A jet of water from a nozzle strikes the tips of vanes on a water wheel which is set in motion and divides the jet into drops which fall on a sector of the roof. The spinning wheel also rotates the cooler on its support through gears, causing the spray to cover the roof surface gradually. In addition to covering advantages, the folder gives information on installing, adjusting, and maintaining the unit, and also gives data on operating costs. A performance diagram is included.

Feedwater Treatment

HPAC 114—The "Briquet System" of boiler feedwater treatment, which utilizes 1 lb. egg-shaped briquets, is described by Permutit Co., 330 W. 42nd St., New York 18, in a new 4 page folder. Selection of the feeding method (bypass pressure feeding, manual feeding, etc.) and typical installations are discussed. Also illustrated are kits for testing hardness, alkalinity, chlorides, sulfite excess, etc. The chemical compositions of briquets are selected for specific conditions.

Gas Burner Service Guide

HPAC 115—Adams Mfg. Co., 1530 St. Clair Ave., Cleveland 14, has published a 10 page servicing manual which gives safety rules and lists servicing suggestions for gas burners under columns dealing with symptoms, possible causes, and remedies. Symptoms discussed include furnace overheating, burner cycling too frequently, flashback or burning at the orifice, burner does not operate, insufficient heat, chattering gas valve, flame lifting from the burner port, and floating flames. Copies of the booklet may be obtained from the manufacturer for 50 cents each. Discounts are available for quantity orders.

Heating Controls

HPAC 116—A new 61 page catalog and price list on its automatic heating controls has been issued by Min-

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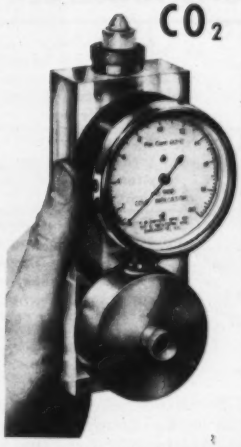

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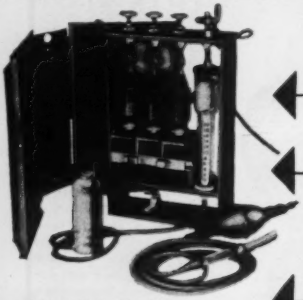

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neapolis-Honeywell Regulator Co., Minneapolis 8. Virtually all types of controls for gas, oil and coal heating, refrigeration, air conditioning, etc. are covered. There is a four page section on commercial controls and a special section on the factors which should govern the selection of control systems. Reconditioning prices are given, and there is a new cross index system.

Insulating Fire Brick

HPAC 117—Johns-Manville, 22 E. 40th St., New York 16, has issued an illustrated four page booklet covering advantages, refractory properties, physical and thermal characteristics and industrial applications of the JM-3000 insulating fire brick, designed for sustained use at 3000 F. The folder also summarizes information on accessory materials and other insulating brick.

Low Temperature Humidity Control

HPAC 118—Features of its system of humidity control are outlined in a folder (K-151) issued by Kathabar Div., Surface Combustion Corp., Toledo 1. The system is said to make possible the first effective method of combining chemical dehumidification with mechanical refrigeration to obtain air of extremely low dew point at sub-zero temperatures and without formation of frost on coils. Operating advantages, design features, and diagrams of various hookups are included. Applications stressed include test rooms, wind tunnels, spray booths, and many industrial low temperature, low humidity processes.

Mercury Plunger Relays

HPAC 119—Ebert Electronics Corp., 185-09, Jamaica Ave., Hollis 7, N. Y., has issued a 4 page bulletin covering its mercury plunger relays designed for current loads up to 35 amp, 115 volts; 25 amp, 230 volts, a-c. Diagrams illustrate the operating principle of both normally open and normally closed relays. Prices are given for all types.

Piloted Type Coupling

HPAC 120—Bulletin 4115, issued by Falk Corp., Milwaukee 8, describes the type P pilot operated coupling designed to support a long shaft extension or floating shaft. Diagrams are used to illustrate the axial and torsional flexing action of this "Steelflex" coupling. Sizes, maximum speeds, basic ratings, and dimensions are given.

Piston Rings

HPAC 121—A new 16 page booklet describing 13 types of metallic piston rings for industrial and marine use replaces an older catalog of Double Seal Ring Co., P.O. Box 550, Forth Worth, Tex. Included are drawings of typical ring installations in two and four cycle diesel or gas engines, ammonia compressors, pneumatic compressors, steam engines, and pumps. Information and recommendations for end, side and back clearance and radial thickness are features of the bulletin.

Protective Coatings for Aluminum

HPAC 122—"Alodizing" is an electroless protective surface conversion process for bonding paint to aluminum and protecting the metal. Amorphous phosphate coatings are used and may be applied by immersion, brushing, or spraying. A four page folder issued by American Chemical Paint Co., Ambler, Pa., gives detailed information.

45

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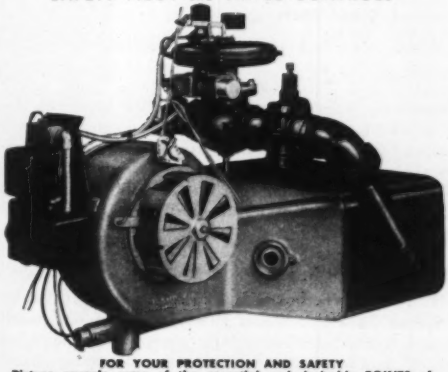

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Refrigeration Specialties

HPAC 123—Catalog 511, covering specifications and prices of refrigeration parts and accessories produced by the Wabash Mfg. Co., 2300-18 S. Western Ave., Chicago 8, features the expanded line of brass dryers, which are now available in the ½ in. SAE fitting, and the new small packages of "Easy Flow" silver solder.

Registers and Grilles

HPAC 124—The registers and grilles of Louvra Corp., 979 Lehigh Ave., Union, N. J., are made of 21 ga mild treated steel, are bonderized, and utilize rubber gaskets. The series 110 grille is a multi-directional unit designed for easy control of air flow and high velocities. Two new descriptive leaflets are now available from the manufacturer.

Removal of Limestone Crusts

HPAC 125—"Crustex" ultrasonic wave producing apparatus transmits high wave impulses to the liquid being treated. It is a continuous process and limestone particles are crystallized and fall to the bottom of the container. It is recommended for use in steam boilers, water heaters, industrial washing machines, air conditioning plants, and wherever limestone deposits are sources of trouble. Information is given in a one page bulletin prepared by Velan Engineering Co., 1 Exchange Pl., Jersey City, N. J.

Rotary Blowers

HPAC 126—Engineering layout information, ratings, and design and application data are given for the "Standardaire" rotary type blower of Standard Stoker Co., Inc., 370 Lexington Ave., New York 17, in a new four page bulletin. Capacities range from approximately 50 to 6000 cfm and discharge pressures range from 4 to 20 psi.

Squirrel Cage Motors

HPAC 127—Types EP and JP polyphase squirrel cage motors of the totally enclosed, fan cooled design are described and illustrated in a four page folder recently released by Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14. These motors, of cast iron construction, are designed for general and industrial uses. Type EP motors are the standard, totally enclosed fan cooled type; type JP motors are explosionproof for Class I, Group D hazardous locations. Both types are built in ratings from 2 to 250 hp.

Stainless Tubing Steels

HPAC 128—Technical Bulletin 19, issued by Babcock & Wilcox Tube Co., Beaver Falls, Pa., covers 10 austenitic and ferritic stainless tubing steels. It contains condensed data on analyses, oxidation resistance, thermal treatment, and mechanical, electrical and physical properties.

Steel Boilers

HPAC 129—Commemorating its 65th anniversary, Fitzgibbons Boiler Co. Inc., 101 Park Ave., New York 17, has issued an eight page bulletin describing its history, growth, and development, together with manufacturing facilities. The company's various steel boilers are briefly described and illustrated.

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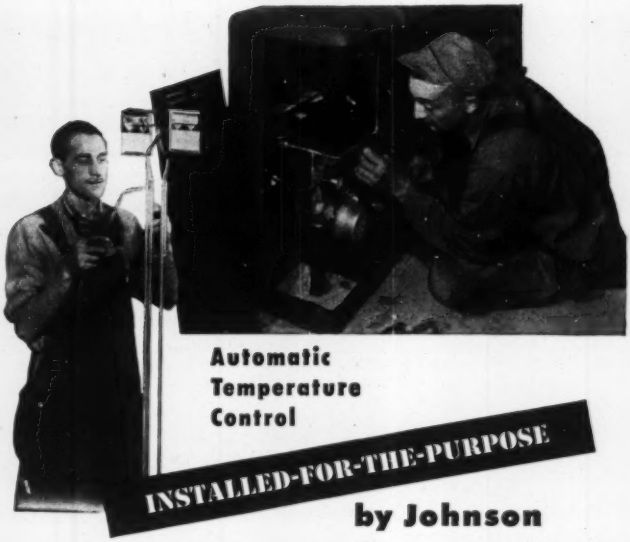

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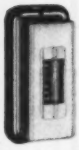

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